CORRECTIVE MEASURES STUDY
ROTH BROS. SMELTING CORP.
EAST SYRACUSE, NEW YORK

by

H&A of New York
Rochester, New York

for

Roth Bros. Smelting Corp.
East Syracuse, New York

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DIVISION OF HAZARDOUS
SUBSTANCES REGULATION

File No. 70185-43
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Geotechnical Engineers &
Environmental Consultants

16 July 1993
File No. 70185-43

New York State Department of
Environmental Conservation
50 Wolf Road
Albany, New York 12233

Attention: Mr. Paul Counterman

Subject: Corrective Measures Study
Roth Bros. Smelting Corp.
East Syracuse, New York

Ladies and Gentlemen:

On behalf of Roth Bros. Smelting Corp., H&A of New York is pleased to submit this Corrective Measures Study (CMS) for the Roth Bros. Smelting Corp. Site. The CMS was performed in accordance with the agreement between Nixon, Hargrave, Devans & Doyle (NHDD) and H&A of New York (H&A) dated June 1990, authorized on 10 August 1990.

The CMS develops and evaluates the corrective action alternatives and recommends the corrective measures to be taken at the Roth Bros. site. Please note the corrective measures recommended are dependent on designation of a Corrective Action Management Unit (CAMU) at the site. Therefore, as recommended by Steve Kaminski's letter of 8 June 1993, this CMS includes supporting documentation and a variance petition to allow designation of a CAMU by the Commissioner.

We look forward to NYSDEC's response at your earliest opportunity. Please do not hesitate to contact us if you have any questions.

Sincerely yours,
H&A OF NEW YORK

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EXECUTIVE SUMMARY

This document constitutes the Corrective Measure Study (CMS) for the Roth Bros. Smelting Corporation site in East Syracuse, New York. This CMS identifies and evaluates alternative Corrective Measure Technologies for remediation of soil and sediment previously identified on site. These soils and sediment contain elevated levels of total lead, TCLP lead, and PCBs.

The goal of this corrective measure study is to evaluate, select, and recommend corrective measures options that best suit environmental conditions at the site, risk-based clean-up objectives, and regulatory criteria. Further, this CMS also evaluates applicability of a Corrective Action Management Unit (CAMU) at the site in the context of the corrective measures considered. This CMS was developed in accordance with USEPA Guidance (RCRA Corrective Action Plan), and contains supporting documentation as required for designation of a CAMU (16 February 1993 Federal Register).

Background Information Summary: The site is located at 6223 Thompson Road in East Syracuse, New York and consists of Roth Bros. Plants 1 and 2. Both plants have been evaluated through RCRA Facility Assessment (RFA) and RCRA Facility Investigation (RFI). However, only Plant 2 is subject to corrective measures. Roth Bros. Plant 2 was formerly a secondary lead smelter; lead smelting operations closed in July 1991 to expand aluminum secondary melting and refining operations.

Based on the RFA and RFI investigations performed at Plants 1 and 2, it was determined that selected areas of soil and sediment at Plant 2 contained elevated levels of total lead, TCLP lead, and PCBs. In summary, soils and sediments considered as potentially subject to corrective measures to be considered under a CMS included:

mainly not
How about total lead
over 250 ppm? !

- TCLP lead concentrations above the regulatory threshold of 5.0 ppm;
- Total lead concentrations within or above the USEPA reference range of 500 to 1,000 ppm (OSWER Guidance, dated 4 June 1992); Call DOH NO / not yet
- PCB concentrations above the USEPA PCB spill cleanup guidance concentration of 25 ppm. Call DOH!

RFI investigations indicated the affected soils and sediment to reside primarily in a northern fill area located north of Plant 2 and, to a lesser extent, in drainage ditch sediments on the Roth property and down stream of SPDES Outfalls 001 and 002, and in several scattered, small areas of soil fill.

Groundwater wells were also established within, upgradient, and downgradient of the affected soil and sediment areas. Based on three rounds of groundwater sampling events, it was concluded that groundwater has not been adversely impacted by presence of these compounds in fill and sediment at the site. Quarterly sampling is continuing at the site.

Risk Evaluation: Criteria for corrective action for TCLP lead and PCBs are relatively clear in USEPA regulation and guidance. However, USEPA has only established a reference range for total lead concentrations in contaminated material, to be used as a basis for further evaluation. Therefore, in accordance with RCRA Corrective Action Plan Guidance, a risk evaluation of total lead levels at the Roth Bros. site was performed as part of this CMS. The risk evaluation was based on USEPA's uptake/biokenitic model, which evaluates potential for total lead exposures to result in unacceptable blood-levels in children, the most sensitive population subject to potential exposure.

In accordance with the model, potential on and off-site exposures were evaluated, based on the site specific lead analyses performed across the Plant 2 area. Two conservative distributions of lead concentrations were used: 1) a lead value based on all detected concentrations from ground surface up to 2 feet in depth, representing a "more-likely case" exposure scenario, and 2) a lead exposure based on all lead containing soils/fill with concentrations >500 ppm, to represent a conservative "worst-case" scenario. Other contributions to a child's blood-lead burden such as ingestion of food and drinking water and inhalation of household dusts were also included in the model exposure evaluation. Based on the sum total of these exposures, the model indicated that exposure to concentrations of total lead above 825 ppm would potentially produce unacceptable blood lead levels (blood values >10 ug/dl - US Center for Disease Control threshold value) in an exposed child.

The model indicated that to prevent such risks remedial alternatives should include soil treatment to immobilize lead, and increase particle size to prevent exposure through dust generation and inhalation. Further methods to cutoff a contact exposure route should also be considered where exposed soil lead levels exceed 825 ppm. Accordingly, the CMS evaluated methods to reduce TCLP lead levels below the 5.0 ppm criteria, and reduce, stabilize, and/or isolate soils containing total lead above 825 ppm and PCBs above 25 ppm. Further, please note that concentrations of PCBs >50 ppm are required by regulation to be disposed at an EPA-approved incinerator or chemical waste landfill. Therefore, removal alternatives were considered for these particular wastes.

CMS Evaluation and Outcome: Several corrective measure technologies were screened in accordance with the RCRA Correction Action Plan Guidance. The screening process included impacts of site characteristics, waste characteristics, and technology limitations. The corrective measure alternatives reviewed included:

- No action
- Excavating and off-site disposal
- Caps/slurry walls
- Encapsulation
- Soil washing
- Electrokenitic leaching
- In-situ vitrification
- Secondary smelting
- In-situ solidification
- Ex-situ silicate solidification/stabilization
- Ex-situ polysilicate stabilization/mineralization

Specific criteria against which these technologies were considered included technical concerns (performance, reliability, implementability), environmental concerns (short and long-term effects and effectiveness), human health concerns (protectiveness of human health during and after implementation), institutional concerns, costs, and compatability with a CAMU designation.

Review of the alternatives revealed the following (see Table III for a comparison summary):

- No action alternative - It was determined the no action alternative would not satisfy environmental concerns for disposal of hazardous waste nor would it mitigate the potential risk determined by the uptake/biokenitic model. The option would require monitoring at a cost of approximately $15,000 to $25,000 per quarter.

- Excavation/Off-site Disposal Alternative - This alternative would result in acceptable remediation at the site. However, toxicity, mobility, and volume of hazardous materials would have to be managed at an off-site permanent facility, thereby only shifting the problem. Estimated costs range from approximately $275 to $360 per ton. In addition, continued monitoring would be necessary at $15,000 to $25,000 per quarter to confirm effectiveness. It was determined that this alternative was only necessary for the PCB wastes at concentrations >50 ppm.

- Isolative/Capping Alternatives - These alternatives included the cap and slurry walls and encapsulation alternatives. These alternatives, without treatment of the material prior to capping or encapsulation will not satisfy all of the environmental criteria, particularly reduction of toxicity and volume of hazardous waste. Costs range from $36 to $62 per ton. Groundwater monitoring would also be required at approximately $15,000 to $25,000 per quarter for an extended period of time.

- Reduction Alternative - These included alternatives to reduce total lead concentrations in soil. It was determined that while these may reduce the volume of contaminated material, the reduction technologies alone could not be used at the site since they would not correct TCLP waste problems nor are they applicable to PCB wastes. Further, technology developers expressed potential severe limitations for the type of material (mixed fine grained soil and debris) present at the Roth site. Costs for reduction alternatives alone ranged from $50 to $150 per ton. Monitoring costs would also apply as would costs associated with treating TCLP and PCB wastes.

- Immobilization Alternatives - These included a range of alternatives from vitrification to solidification and stabilization. It was determined that solidification/stabilization alternatives would resolve TCLP and PCB waste issues, and would resolve the potential exposure risk issues associated with total lead when applied to soils >825 ppm total lead. Developers of the various solidification/stabilization alternatives also represented the longest term performance and experience record. In summary, treatment by one of these alternatives would eliminate the presence of defined hazardous wastes at the facility, and would result in elimination of the health risks apparent from the uptake/biokenitic model. Stabilization costs range from $40 to $195 per ton. Depending upon the vendor selected, methods are available that result in no or more minimal volume increase and result in a non-hazardous solid waste which is granular and workable, and therefore can be used for subsequent parking, storage area, or building support.

and under?

CAMU Evaluation

Of the alternatives screened, it was determined that effective implementation of corrective measures at the site required consolidation of the affected soil and sediment at a central area where it could be processed, treated, and placed. This would require designation of a Corrective Action Management Unit (CAMU). The seven criteria required to support designation of a CAMU have been included in this CMS. In addition, a petition for variance from selected requirements 6NYCRR Part 373 and 376 which would allow the Commissioner of NYSDEC to designate a CAMU for this facility has been included in an appendix to the CMS.

In summary, the recommended corrective measure consists of: Call DOff

1. Removal and proper off-site disposal of wastes with >50 ppm PCB. Approximately volume of these materials is estimated to be 870± cu. yds. (1,200± tons); cost of this is estimated to be approximately $275 to $360/ton.

2. On-site polysilicate stabilization or equivalent treatment of TCLP lead wastes (>5 ppm), total lead materials >825 ppm, and remaining PCB materials >25 ppm. Estimated volumes to be treated are 14,800± cu. yd. (20,720± tons) at estimated costs of $58± ton for this treatment. Call DOff

3. Placement of treated material in a designated CAMU with a limited cap (building, pavement or other) to control runoff access and long term effectiveness. The estimated area that may require final cap is approximately 66,500 sq. ft. (1.5± acres). Alteratively, placement with limited grading, topsoil and seeding, and limited administrative controls to control access could accomplish the same objectives. The consolidated placement area (CAMU) should be located to the maximum extent possible, over the existing contaminated northern fill area in order to comply with CAMU designation criteria.

These recommendations should be carried forward into Corrective Measure Implementation (CMI) design and, upon approval, implemented. The CMI design should also summarize specific cost estimates, once design features are better defined.

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I. INTRODUCTION

This document shall serve as the Corrective Measures Study (CMS) for the Roth Bros. Smelting Corp. (Roth Bros.) in East Syracuse, New York, as shown in Figure 1. The purpose of the CMS is to identify and evaluate alternative Corrective Measure Technologies for remediation of soil and sediment previously identified on site. The goal of this study is to make a selection of Corrective Measure Options that best suit environmental conditions at the site, risk-based clean-up objectives and regulatory criteria. This document summarizes relevant existing information regarding current site conditions, defines specific remedial objectives, screens corrective measure technologies relative to remedial objectives and regulatory criteria, and identifies the corrective measure alternatives that best meets these objectives and criteria at the Roth Bros. site. This CMS also evaluates applicability of a Corrective Action Management Unit (CAMU) at the site in the context of the corrective measures considered. Guidance for developing this CMS was obtained from the United States Environmental Protection Agency (USEPA) document entitled "RCRA Corrective Action Plan" (14 November 1986). Further, supporting documentation for designation of a CAMU at the facility has been included based on the CAMU final regulation published in the 16 February 1993 Federal Register. These and other additional references are noted in the text and listed at the end of the report text.

This document is structured as follows:

- Section II provides a brief review of site history, a description of regulatory and technical background of the site, and an overview of the environmental investigations conducted to date;

- Section III presents a detailed summary of previous investigation results, existing environmental conditions on site, and conservatively evaluates exposure risks associated with compounds subject to corrective action.

- Section IV identifies the Corrective Action Objectives to be achieved through remediation and application of Corrective Action Management Unit (CAMU) criteria to the site;

- Section V provides a description of the methods of technology and alternatives screening for this site;

- Section VI presents a detailed description of Corrective Measure Technologies, and viability of the alternatives.

- Section VII identifies the Corrective Measure Alternatives which pass the screening process; specifically evaluates the alternatives with respect to RCRA and CAMU criteria; provides a recommendation of the Corrective Measure(s) selected for the site, as well as justification for selection of the measure(s) and designation of a CAMU at the site. Please note that a petition for variance from selected 6NYCRR Part 373 and 376 requirements must be granted to designate a CAMU at the facility. Such petition is appended to this CMS.

These sections are supported by tables, figures and appendices, where applicable.

II. BACKGROUND

2-01. SITE LOCATION

The site is located at 6223 Thompson Road in East Syracuse, New York (See Project Locus, Figure 1). Roth Bros. operate two plants (Plants 1 and 2). Both plants have been evaluated through RCRA Facility Assessment (RFA) and RCRA Facility Investigation (RFI), however only Plant 2 is subject to Corrective Measures. Limited discussion is presented on both plants to orient the reader to site locations and conditions.

Plant 1 is bounded by Oberdorfer Foundries, Inc. on the north; Thompson Road on the east; Hoffman Air and Filtration Systems Co. on the south; and railroad tracks and Roth Bros. Plant 2 on the west. Roth Bros. Plant 2 is bounded by industrial property on the north; a construction equipment rental company, Oberdorfer Foundries, Inc. and Plant 1 of Roth Bros. on the east; railroad tracks on the south; and an industrial park on the west.

Both Plants 1 and 2 properties are generally rectangular in shape. Roth Bros. also own a strip of land associated with a right-of-way off Thompson Road. This section of the property is located at the northeast edge of Plant 2, and is bounded by a construction equipment rental company to the north, Oberdorfer Foundries to the south and an access road to the east.

2-02. SITE OPERATIONS

The Roth Bros. Smelting Corp. was established in 1927. Their operations began at the Thompson site in the early 1950's. Plant 2 was added in the mid-1950's. Currently, Roth Bros. occupies a 32-acre property, and Plants 1 and 2 occupy over 200,000 sq. ft. of building space. The facility manufactures aluminum ingots and sows. Roth Bros. formerly also was a secondary lead smelter, however the lead smelting operations closed in July 1991 to expand aluminum operations.

Roth Bros. reclaims non-ferrous metals and alloys through secondary melting and refining of purchased scrap. Plant 1 is primarily used for melting operations for aluminum. Historically, zinc alloying operations took place in Plant 1; however, Roth Bros. is not currently involved with zinc alloying. Plant 2 was historically used for the lead smelting operations. Since lead smelting operations have closed, Plant 2 is now used for aluminum operations.

Scrap metals are processed such that valuable metal components are separated through a series of physical and chemical reactions using refractory-lined furnaces. The end product is aluminum with controlled amounts of additives to form desired product or alloys.

2-03. INVESTIGATIONS CONDUCTED TO DATE

Several phases of investigation have been performed to date:

- H&A of New York conducted two environmental investigations on Plant 1 (1*) and two environmental investigations on Plant 2 (2), the results of which were in two reports (one each for Plant 1 and 2) and provided to NYSDEC in May 1991. These reports have also been provided to the USEPA. NYSDEC reviewed these reports and provided guidance that these investigations may be considered as a partial RFI (3). Blasland & Bouck Engineers performed a limited soil investigation at Roth Bros. site and reported on it on 28 December 1989. A copy of the report was included in H&A's 10 February 1992 letter response to the NYSDEC (4) and H&A's 10 April 1992 letter response to the USEPA (5).

- Galson Technical Services conducted a limited sampling and analytical program in April 1990 at the site as part of an environmental audit of the facility. The results of this investigation were incorporated in H&A's Environmental Investigations (1,2). A copy of the results of the Galson program were also included in an H&A of New York letter response to NYSDEC dated 10 February 1992 (4).

- A.T. Kearney prepared a Draft RCRA Facility Assessment (RFA) on the Roth Bros. site (including Plants 1 and 2) and submitted the report to the USEPA in October 1991 (5). Comments on the Draft RFA were submitted on behalf of Roth Bros. by H&A of New York on 10 April 1992 (6).

- H&A prepared a work plan for RFI completion for the site that addressed remaining investigations not provided in the above-listed investigations (7). The work plan was approved by NYSDEC, the work performed, and a report on the additional activities was prepared and submitted to NYSDEC in March 1993.

- Finally, as a result of closure of the secondary lead smelting operations, Roth Bros. Part 373 permit closure plan for its hazardous waste storage areas was implemented, the areas closed in conformance with the plan, and reports on the closure dated 28 October 1992 and 23 December submitted to NYSDEC (8). Closure of the Plant 1 area and the majority of the Plant 2 area has been approved by NYSDEC. Details of closure of the western end of the Plant 2 storage area only are pending with NYSDEC.

The results of these investigations are summarized in Section III of this CMS.

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*Number in parentheses refers to "Sources of Information" following the text in this report.

III. OVERVIEW OF SITE ENVIRONMENTAL CONDITIONS

A detailed summary of previous site investigation is presented below in chronological order of their performance. H&A's initial two phases of investigation (report dated May 1991) form the basis for later efforts (RFA and RFI) so they are described in greatest detail below and resulting conclusions are modified as determined by the later investigations. Conclusions and recommendations of the RFI are then used to evaluate risk associated with site compounds subject to corrective action.

H&A of New York conducted two phases of environmental investigations on both Plants 1 and 2, the results of which were summarized in two reports and provided to NYSDEC in May 1991. A discussion of the results is provided below. The NYSDEC reviewed these reports and provided comment in a letter dated 3 July 1991. Items identified as needing further investigation were addressed in an H&A 10 February 1992 letter and discussed in a meeting 6 May 1992. These action items were addressed in the RFI Work Plan dated 14 August 1992, which was modified, approved by NYSDEC and implemented. Results of the remaining RFI activities were submitted to NYSDEC in a report dated March 1993.

3-01. SUMMARY OF INITIAL DETAILED ENVIRONMENTAL INVESTIGATIONS

Plant 1

Based on the initial environmental investigation performed on Plant 1 (1), it was determined that a limited program of subsurface exploration and environmental sampling was necessary to supplement H&A's initial investigation to further evaluate the presence of hazardous materials on Plant 1 property which may result from foundry sands on adjacent property to the north. The adjacent property (Oberdorfer Foundries) is a former NYSDEC listed inactive hazardous waste site (site was delisted in 1992). An investigation program was developed to explore and evaluate the possible adverse influence groundwater quality from Oberdorfer may have on Plant 1. H&A's investigation included a limited subsurface exploration program of three shallow test borings, three groundwater observation well installations and limited sampling and analyses of groundwater for compounds typically associated with foundry sands. Exploration locations are shown on Figure 2. In summary, based on the information obtained, it was concluded hazardous compounds typically associated with foundry sands (phenols, cyanide) had not measurably impacted groundwater quality in the areas evaluated at the Roth Bros. Plant 1 property. Recently, much of the Oberdorfer foundry sands have been removed from the Oberdorfer property.

Plant 2

H&A's initial phase of investigation identified several Plant 2 areas for additional study (2). The additional environmental investigation objectives in each area were to evaluate the presence of selected oil and/or hazardous substances associated with the area; apparent extent of the substances; and preliminary review potential remedial alternatives for areas found to contain the substances. Specific areas of investigation included: 1) an equipment maintenance area and associated underground tanks for petroleum product release; 2) an area of fill (paved and unpaved) north of Plant 2 which showed elevated lead and PCB levels in selected areas in the initial investigation; 3) baghouse/hazardous waste storage area, again where previous sampling showed elevated lead and PCB concentrations; and 4) associated drainageways associated with the fill and baghouse areas.

The additional investigation included the installation of 93 shallow test borings, 12 observation wells, and 2 test pit trenches. Fifty-eight soil samples were collected and analyzed for total lead, TCLP lead and PCBs. Ten soil samples were collected and analyzed for total organic carbon and cation exchange capacity. In addition, 17 samples (soil, baghouse dust and emission particulates) were collected and submitted to the University of Rochester for lead isotopic analyses to assist in evaluation of lead sources. Groundwater from each of the observation wells was collected and analyzed for aluminum, calcium, iron, potassium and lead (both total and dissolved metals) and PCBs. Two groundwater samples were also analyzed for total petroleum hydrocarbons from the maintenance shop tank area.

Results of analyses performed on samples collected during the Plant 2 additional investigation are discussed below. Tables of the results of previous site sampling have been assembled in Appendix A.

3.1.1 Maintenance Shop Area

Four soil borings, two of which were converted to groundwater monitoring wells, did not indicate the significant presence of petroleum related compounds. Total petroleum hydrocarbon (TPH) analyses were performed on groundwater samples from the wells and 4.52 ppm TPH was detected in one well. It was concluded that this concentration is not indicative of free petroleum or significant dissolved petroleum in the samples.

Some petroleum staining in soil was evident in our initial investigation in this area. Under NYSDEC policy, it was concluded if such soils require excavation and removal from the site (such as for foundation construction), special handling or disposal requirements may apply for management of the material as a special solid waste, but not as a hazardous waste.

3.1.2 Fill and Baghouse Areas

Total lead concentrations detected in soil samples were elevated at several locations in the Fill and Baghouse areas.

TCLP lead concentrations were detected in soil samples at concentrations above the 5.0 ppm EPA regulatory limit in several soil sample locations in the Fill and Baghouse areas. These samples are, therefore, characteristically hazardous by this method and require corrective action.

PCBs were detected in several samples in the Fill and Baghouse areas above the EPA PCB Spill Cleanup Guidance Concentration (25 ppm-see Section IV) and require corrective action.

Samples with high lead concentrations also frequently exceeded the TCLP regulatory limit. Several of the samples with high PCB concentrations also had high lead concentrations. Therefore, these compounds were considered as primary compounds of interest throughout subsequent investigations.

3.1.3 Groundwater

Twelve wells were installed across the site to determine groundwater flow direction and to collect samples at both upgradient and downgradient locations.

Evaluation of groundwater for potential presence of smelter-related compounds derived from the fill and baghouse areas was performed by sampling for the compounds of interest (lead, PCBs) as well as indicator parameters to evaluate effects of sediment in samples (iron, calcium, aluminum, potassium and leachability (pH).

Lead was detected in one groundwater sample (filtered for soluble lead) at 0.117 ppm during an initial sampling round. The lead presence may have been due to turbidity in the groundwater, therefore the well was redeveloped to reduce the turbidity. A second sampling event, following redevelopment of the well, indicated a concentration of 0.0142 ppm dissolved lead, below the NYS Class GA (protected for drinking water source) groundwater quality criteria of 0.025 ppm.

Iron (dissolved) was detected in groundwater in B278-OW, B279-OW and B290-OW at concentrations above the NYS water quality criteria of 0.300 ppm. The criteria is an aesthetic-based, not health-based, criteria. Concentrations of 1 to 5 ppm dissolved iron in groundwater are common, indicating the concentrations detected on site fall within the common range, with one exception. B279-OW, in the fill area, had a concentrations of 8.75 ppm iron. The high iron may be due in part, to natural conditions in groundwater.

In summary, it was concluded that groundwater had not been adversely impacted by the presence of fill at the site. Additionally, based on the apparent groundwater flow direction and the results of groundwater analyses, it appeared unlikely there would be off-site migration of metals in groundwater.

In summary, based on site observations and sampling, several areas of soil/fill material and sediments in the Fill and Baghouse areas were identified as potentially requiring corrective action for the presence of lead (TCLP and total) and PCBs. Soil, fill and sediment were determined to potentially be subject to corrective action, assuming materials containing PCBs >25 ppm and TCLP lead >5 ppm were remediated. These initial estimates did not consider specific risk evaluation for elevated total lead concentrations to determine a threshold concentration for corrective measures parameters (see below Section 3-04). Further, based on the observed groundwater flow direction and analyses of groundwater collected downgradient from the affected soils, it was concluded groundwater would not require corrective action.

3.1.4 Preliminary Review of Corrective Measure Technologies

H&A of New York performed on initial review of six potential Corrective Measure Technologies (CMTs) as part of the Environmental Investigations for the Plant 2 study. CMTs reviewed included no action, in-situ solidification, silicate stabilization, capping in-place, off-site landfill disposal, and in-situ vitrification. The alternatives were reviewed on a preliminary basis for applicability to the site, potential effectiveness, performance and cost. Additional screening of these CMTs is performed in this CMS.

3-02. RCRA FACILITY ASSESSMENT

A Draft RCRA Facility Assessment (RFA) Report was performed by A.T. Kearney for the USEPA (draft document dated October 1991). The draft RFA report consisted of a visual site inspection and a preliminary review of USEPA and NYSDEC files. Results from the environmental investigations performed by H&A were incorporated into the draft RFA report.

In summary, the Draft RFA identified 48 Solid Waste Management Units (SWMUs) and two Areas of Concern (AOC) at the Roth Bros. Site. SWMUs and AOCs requiring additional investigation were addressed in remaining RFI activities, as summarized below.

3-03. RCRA FACILITY INVESTIGATION

The 2 phases of environmental investigations at Roth Bros. Smelting Corporation - Plant 1 and Plant 2 Report (May 1991) were deemed by NYSDEC to serve as a partial RFI. Further activities consistent with NYSDEC/USEPA information requests were reported on in Results of Remaining RCFA Facility Investigation Activities (report dated March 1993).

The objectives of the additional RFI investigation activities were to expand the site soils database, expand the outfall sediment database, collect data at selected SWMUs, and expand the groundwater analytical database. Of special interest during this investigation were the goals of confirming selected lead distribution data in the fill area and assessing volatile, semivolatile, dioxin/dibenzofuran compound presence.

The results of the investigation lead to the conclusion that the CMS should evaluate corrective action for lead and PCBs in selected SWMUs. There was no evidence of groundwater contamination at the time of RFI report preparation (March 1993). Quarterly sampling has continued at the site and to date shown no change in this status. (Please note that such sampling will continue for selected parameters identified in the Groundwater Sampling Plan, dated December 1992, through performance of Corrective Measures). The RFI report showed dioxin/dibenzofuran levels detected in outfall sediments were below NYSDEC sediment criteria. Further volatile, semivolatiles and pesticides were not detected or present in a pattern indicative of site release. Therefore, evaluation of corrective measures and technologies has been focused in this CMS on lead and PCB presence.

3-04. RISK EVALUATION

USEPA RCRA Corrective Action Plan Guidance requires that actual or potential exposure pathways be evaluated for and form a basis of the Corrective Measures Study. This is intended to confirm those areas where compounds of interest present at a site require corrective action, and to determine that a selected corrective measure alternative is sufficient to mitigate the health and environmental risks associated with those compounds.

The basis of risk evaluation involves determining the fate and transport characteristics of the compounds of interest at a site, evaluating potential receptor locations, determining receptor concentrations, and determining the likelihood of significant health/environmental risks resulting from the exposure.

A number of physical and chemical properties and site-specific conditions influence the fate and transport of chemicals in the environment. Ultimately these processes affect the potential exposure routes for human and environmental receptors. Expected transport and fate of lead and PCBs are discussed below.

Lead is a naturally occurring element and is a major constituent of more than 200 identified minerals. It is insoluble in water at pH levels associated with most natural waters. It strongly sorbs to particulate matter (clays and organic matter) and therefore fate and transport are dependent upon presence and migration of such material through wind or water erosion.

Humans are generally exposed to small amounts of lead on a daily basis, but it is not a necessary nutrient, rather it is toxic at high enough concentrations. The major source of daily intake of lead for adults and children is food and beverages. However, recent investigations by USEPA has indicated that consistent sources of lead exposure that may influence health in children (the most sensitive receptor) result from inhalation exposure routes (automotive and industrial emissions), drinking water ingestion (from lead pipe solder), and through ingestion of lead-based paint. Accordingly, USEPA has not established a reference dose (Rfd) for lead exposure and instead has established guidance for determining soil clean-up levels based on risk evaluation that accounts for these routes of exposure as well as exposure to contaminated soils at RCRA or CERCLA facilities. This effort has lead to development of an Uptake/Biokinetic Model that evaluates the potential for this range of lead exposures to result in unacceptable blood-lead levels in children (10). Potential risk associated with lead concentrations at the Roth site have been evaluated accordingly, as described below.

PCBs are a group of man-made chemicals composed of 209 individual compounds. PCBs have been used widely in coolants, lubricants, and dielectric materials in selected electrical equipment. Industrial manufacture of PCBs stopped in 1977. As a synthetic organic chemical, PCB fate in the environment is dependant on its solubility, Henry's Law Constant, organic carbon partitioning coefficient (K_{oc}) and chemical half-life. PCBs are persistent (long half-life), have low solubility (generally $<10^{-1}$ mg/l), have a low vapor and Henry's Law Constant (therefore don't volatilize), and have a high K_{oc} (>500,000 mg/g). In summary, PCBs tend to sorb to fine sediments and organic matter; and, migration is dependant on similar processes as those that affect lead.

PCBs can enter the body through ingestion, inhalation, or skin contact routes. Skin irritations characterized by an acne-like condition, rashes, and liver effects were the only significant adverse health effects reported in PCB exposed workers. Epidemiological studies of workers occupationally exposed to PCBs thus far have not detected any conclusive evidence of an increased incidence of cancer in these groups (11). Due to these factors, USEPA has established a range of total PCB concentrations, based primarily on land use and potential for human exposure as a basis for determining PCB clean-up levels. Therefore, a specific risk evaluation relative to this site, similar to the lead risk evaluation below, has not been performed for PCBs. Additional discussion regarding USEPA's PCB clean-up criteria appears in Section 4-01.

3.4.1 Exposure Routes

Possible exposure routes for lead consist of ingestion, inhalation, and dermal contact. The dermal contact route is only an exposure route insofar as it leads to ingestion or inhalation of lead. Lead is not typically absorbable through the skin. An ingestion route may occur through voluntary consumption (pica) or involuntary consumption of lead contained in soil or dust. Ingestion may also occur through consumption of water containing dissolved lead. In this evaluation, the ingestion route has been considered a possible exposure route for: 1) site workers at the Roth facility; or 2) a child at the nearest downwind property line (please note that other industrial facilities surround Roth, so this scenario is conservative). Groundwater is not considered an ingestion route since groundwater has not been shown to be contaminated by lead at this facility (see RFI and prior investigations) and groundwater is not used as a drinking water source at or in the vicinity of the Roth facility.

Inhalation of dust containing lead concentrations is a potential exposure route at the site since certain areas that contain lead concentrations (northern fill area) are unpaved and only partially vegetated. The inhalation exposure routes considered for this facility include an on-site worst case evaluation in the area of exposed lead containing soil, and at the downwind facility boundary, which would be the nearest off-site location for potential inhalation of lead containing dusts.

Evaluation of potential lead exposure to on-site worker's has not been conducted in detail for two reasons:

1. Blood-lead level concentrations in Roth worker's involved in the secondary lead smelting operation were conducted routinely by Roth during the period of lead smelting activities in Plant 2. Results of this blood monitoring indicated no unacceptable excursions of blood-lead levels in workers over a threshold blood-lead level established by OSHA. Since potential exposure during secondary lead smelting operations would have involved daily occurrences to much higher concentrations of lead than are present in the areas subject to corrective action, these blood lead levels are indicative of lower risk associated with the areas subject to corrective action.

2. The USEPA Uptake/Biokinetic Model targets humans at greatest risk to lead exposure, namely children. Accommodations for adult exposure is not made in the model since USEPA has determined clean-ups should take place to be

protective of the most sensitive segment of the population. Accordingly, adult exposures (i.e. on-site workers) cannot be evaluated using the Uptake/Biokinetic Model.

3.4.2 Lead Risk - Uptake/Biokinetic Model

Generally, the Uptake/Biokinetic Model considers all of the routine potential sources of lead exposure for a child. That data can then be used to consider the concentrations of a particular source (such as contaminated soil) that may trigger unacceptable blood lead levels in the child (concentrations >10 ug/dl). Once such concentrations are known, they can be used to determine areas subject to corrective action and the potential types of corrective action which most effectively eliminate the exposure pathways. This method leads to a conservative estimate of total lead clean-up criteria since all potential sources of lead exposure ("background" and site-specific) are considered relative to the most sensitive receptor (children). The primary components of the model consider the following:

- Exposure Route - The route of exposure of the specific lead contaminated media at the site to a child is considered (see Section 3.4.1 above).

- Sources of Lead - Values are incorporated in the model for "background" exposures resulting from water consumption, dietary intake, household dust, and lead-based paint exposure. Exposure(s) resulting from site-specific lead containing media are then evaluated.

- Site-Specific Data - If site specific data is available for the lead-containing media, the model directs that average concentrations be used to evaluate exposure potential in order to be consistent with the default concentrations associated with background exposures (diet, household dust, etc.). For the Roth Bros. site, concentrations of lead-containing soils/fill/sediment (Appendix A) were evaluated to determine normality of distribution and the data was determined to fit a log-normal distribution (see Table 1). The data did not fit an arithmetic normal distribution, therefore a geometric mean was calculated for all lead containing soils/fill with concentrations >500 ppm in order to represent a conservative "worst-case" scenario. A geometric mean for lead concentrations from the ground surface to 2 ft. in depth was also calculated to represent a "more-likely-case" exposure scenario, since it would be soil at and near the surface which would be more likely to contribute to contact or airborne dust exposure.

For the Roth Bros. site, data for lead-containing soils/fill/sediment was used to determine potential airborne dust levels that may contribute to child blood-lead levels. USEPA default values for water consumption, dietary intake, and household dusts were otherwise used. Consumption of lead-based paint was not evaluated since Onondaga County Department of Health data indicates the area around the Roth facility to have a low incidence of child lead-based paint poisoning (12).

Use of the Lead Uptake/Biokinetic Model identifies conditions at which there exists a greater than 5% probability that a child's blood lead levels may exceed 10 ug/dl (level set by US Center for Disease Control for monitoring and possible medical intervention). Under such conditions corrective action would be recommended, which is consistent with the draft proposed OSWER directive for establishing soil lead clean-up levels at RCRA facilities (13).

The following assumptions were used in the model to represent as conservative an estimate of exposure as possible:

1. The most likely exposure point for inhalation exposures is considered the nearest downwind property boundary. Note that Roth is surrounded by other commercial/industrial facilities and has a wood lot several hundred feet deep occupying the northern property area, therefore this exposure scenario is more conservative than actual conditions. The influence of dispersion and dilution on airborne concentrations of lead, following entrainment from areas of exposed soils on the site, was evaluated by modeling exposure point concentrations at the down wind property boundary, approximately 200 ft. from the center of the largest exposed area of soil containing lead concentrations >500 ppm.

2. It was assumed that 100% of the lead-contaminated soils were available for air entrainment.

3. A PM_{10} value (particulate matter <10 μm) of 72 ug/m^3 was used. This represents 40% of the US Dept. of Transportation Total Suspended Particulate value of 180 ug/m^3 which is used for dust conditions at active construction sites with earth moving (14).

4. Background airborne lead levels (from household dusts) were set at 0.200 ug/m^3, the default value for the model (10). Also, default assumptions in the U.S. EPA Uptake/Biokinetic Model account for background child exposures to lead were used, including 4 ug/l in drinking water, 5.88 to 7.48 ug/day in the diet, indoor air concentrations 30% of outdoor levels, and a soil/dust weighting factor of 45 percent (10).

Based on these assumptions, airborne concentrations of lead-contaminated fugitive dusts on-site (i.e., no dilution or dispersion), under the worst-case and more-likely-case conditions were:

Worst-Case:

$$0.200 \text{ ug/m}^3 + (4785 \text{ ug/gm} * 72 \text{ ug/m}^3 * 1 \text{ gm/}10^6 \text{ ug}) = 0.545 \text{ ug/m}^3$$

More-Likely-Case:

$$0.200 \text{ ug/m}^3 + (853 \text{ ug/gm} * 72 \text{ ug/m}^3 * 1 \text{ gm/}10^6 \text{ ug}) = 0.261 \text{ ug/m}^3.$$

Based on these values, under worst-case conditions, the contribution to ambient lead airborne dust levels from entrainment of on-site exposed lead-contaminated soils only elevates values two-fold above background, whereas under more-likely-case conditions, the site contribution to ambient airborne dust lead levels is minimal. These atmospheric lead concentrations are in the low end of the range of values of 0.3 to 3.0 ug/m^3 found within 2 to 5 km (approximately 1 to 3 miles) of active point sources such as lead smelters and battery plants (15) and are therefore considered to be representative.

The airborne concentrations under each set of conditions were conservatively modeled using the near-field box model developed by Pasquill and Horst (16). Fugitive dusts were modeled in a 2-m layer of air on the site, thus the height of the model box (Hb) at a distance of x=200 ft. (60.96 m) downwind of the site was:

$$
\begin{aligned}
Hb &= \ln(0.033 * x^{2.09}) \\
&= \ln(0.033 * 60.96^{2.09}) \\
&= 5.179\text{m}
\end{aligned}
$$

which yields a dilution factor of 5.179m/2m = 2.58. Thus, the estimated airborne lead PM_{10} concentrations at the site boundary, under worst-case and more-likely-case conditions, are:

Worst-Case:

$$0.545/2.58 = 0.211 \text{ ug/m}^3$$

More-Likely-Case:

$$0.261/2.58 = 0.101 \text{ ug/m}^3.$$

The airborne concentrations for lead dusts were then entered into the U.S. Environmental Protection Agency Uptake/Biokinetic Model Version 0.5 (10). As described above, default assumptions for the major routes of exposure (i.e., air, diet, drinking water, and soil/dust) were used; consumption of lead paint was not evaluated. Iterative runs of the model were made, entering various lead soil levels in the soil/dust scenario, to evaluate which lead soil levels triggered risk to children. The latter was evaluated in terms of the lead soil level that produced a blood level in children, ages 12-84 months, at the 95th probability level, that did not exceed the Center for Disease Control threshold level of 10 ug/dl. For this risk evaluation, the Uptake/Biokinetic Model was run for exposures on-site and at the property boundary under worst-case and more-likely-case conditions. The results are tabulated in Table II.

Based on the findings (Table II), under current site conditions (i.e., no corrective action), children exposed to the lead-containing soil/fill through inhalation of fugitive dusts at the property boundary and to background levels of lead off-site through ingestion of food and drinking water and inhalation of household dusts, are at risk where exposed, on-site lead-contaminated soil levels exceed 850 ppm, either under worst-case or more-likely-case exposure conditions. The influence of dilution and/or dispersion on airborne concentrations of lead only appears to impact risk from inhalation exposures under worst-case conditions. Thus, should such an inhalation exposure occur, the lead soil level which is unlikely to produce blood lead levels >10 ug/dl in more than 5% of the children exposed decreases to 825 ppm; however, under more-likely-case conditions, the highest lead soil level not triggering risk remains at 850 ppm (Table II).

Proposed remedial alternatives which include the following should mitigate current risk at the property:

- soil treatment to immobilize the lead and other contaminants;
- will increase particle size (hence reduce the PM_{10}) to eliminate dust entrainment;
- reduces the bioavailability of lead, and/or cuts off the ingestion/potential contact exposure route where exposed soil lead levels exceed 825 ppm (the most conservative exposure point concentration estimate).

The remedial actions are designed to mitigate exposures to lead through direct contact with the contaminated soils, inhalation of lead-contaminated fugitive dusts, and prevent generation of lead-contaminated waters. In summary, in order to meet health risk criteria for corrective action at the Roth Bros. facility, corrective measures should be directed at areas where total lead concentrations exceed 825 ppm. Areas with concentrations less than 825 ppm total lead need not be subject to corrective action unless they exceed other criteria, such as elevated TCLP lead levels or PCB levels (see Section 4-01). Based on the exposure routes which may cause health risk, the evaluation above indicates that preference should be given to corrective action technologies that immobilize lead (to prevent airborne exposure and future groundwater leaching), cut-off contact, and therefore inhalations/ingestion routes of lead-containing materials, and reduce the bioavailability of lead. These factors are considered in subsequent sections of this CMS.

IV. CORRECTIVE ACTION OBJECTIVES

This section of the CMS presents the Corrective Action Objectives to be achieved for soil and sediment. The corrective action objectives are numerical clean-up goals expressed in terms of chemical concentrations for the compounds of interest at the Roth Bros. site. This section also presents a listing of the corrective action technologies reviewed as potential options for the remediation of soil and sediment.

4-01. CLEANUP GOALS FOR SOILS/FILL/SEDIMENT

The clean-up goals for lead and PCBs in soils, fill and sediment at the Roth Bros. site have been evaluated based on the following criteria:

- TCLP Lead - the USEPA has established a concentration of 5 ppm or greater lead present in leachate from the Toxicity Characteristic Leaching Procedure (TCLP) analysis as the basis for determining characteristic hazardous lead waste (greater than or equal to 5 ppm) from non-hazardous (less than 5 ppm).

  Total Lead - For total lead, a reference range for further evaluation has been set by the USEPA at 500-1000 ppm for total lead content in residential settings. The range is based on direct contact with soils. A 500 to 1000 ppm action level has been reported at Superfund sites, in Center for Disease Control policy and by the State of Minnesota (temporary standard) (7,8). OSWER has also established a 500 to 1000 ppm range to trigger lead remediation based site-specific factor evaluation through the USEPA Uptake/Biokinetic Model (10). The 500 ppm end of the range is targeted at child exposure in a residential setting, 1000 ppm is for industrial settings, and site-specific settings may result in an intermediate number.

  Given the industrial setting of the Roth Bros. site and vicinity, reported clean-up goals at other sites under USEPA and NYSDEC review, and results of the site-specific Uptake/Biokinetic Model evaluation, the clean-up objective for total lead in soil is set at 825 ppm.

- PCBs - Non-liquid PCB waste (i.e. in soil, debris and rags) with concentrations equal to or >50 ppm are required to be cleaned up under the Toxic Substances Control Act (TSCA). The USEPA has established a range of total PCB concentrations, based primarily on land use and potential for human exposure as a basis for comparing PCB data. Concentrations less than 10 ppm total PCB are generally considered acceptable at most locations. A range between 10 and 25 ppm is considered acceptable depending on land use; 10 ppm is the comparison criteria where residential/commercial land use prevails and 25 ppm (or lower) is generally acceptable in industrial areas. Concentrations >50 ppm must be disposed at an EPA-approved incinerator or chemical waste landfill (40 CFR 760.60 (d)). Since the site is an industrial site and is surrounded by industrial use, the clean-up objective for CMS evaluation is directed at soils <50 ppm and >25 ppm. Soil/fill with >50 ppm are also subject to corrective action but the acceptable corrective measures, as dictated by regulation, are limited to the two described.

4-02. WASTES IDENTIFIED FOR CORRECTIVE ACTION

Based on discussion above, soil/fill/sediment which exceeds any one or a combination of the following criteria is subject to corrective measures:

1. Leachable lead in excess of the TCLP lead limit of 5 ppm is characteristically hazardous waste.

2. Total lead concentrations in excess of 825 ppm.

3. PCBs in excess of 25 ppm. Further, PCBs in excess of 50 ppm must be disposed only by one of two regulation-specified methods.

The wastes identified at the site fall into four categories, based on location (see Figures 2 and 3). These are refered to as paved and unpaved soil/fill, drainage ditch sediment, storm sewer sediment and surface dusts.

Areas where exceedances of clean-up objectives for lead and PCBs (See Section 4-01) were found to occur are shown on Figures 2 and 3. The outlined areas are estimated based on sampling conducted to date and are subject to confirmation in the field during Corrective Measures Implementation (such as by field x-ray fluorescence XRF for lead or immunoassay analysis for PCBs) to determine actual extent. The following provides a brief description of each area of concern:

- Paved and Unpaved Fill - These areas represent the majority of the materials of concern. Fill depths range from approximately 2 to 6.5 ft. below ground surface. As shown on Figure 2, the lead-affected soils tend to be concentrated on the northeastern end of the Plant 2 parcel. The areas outlined are somewhat patchy in the paved fill area and generally more confined where it is unpaved. Those soils with PCBs >50 ppm are outlined on Figure 2.

- Drainage Ditch Sediment - Two drainage ditches flank the east and west sides of the Plant 2 property on its northern half. The ditches are monitored with SPDES permits at Outfalls 001 and 002. Outfall 001 receives discharges primarily from the western and southern portion of Plant 2. Outfall 002 receives runoff from the majority of Plant 2 including the parking area at the south end of the site. It also receives runoff from the western portion of Plant 1.

- Storm Sewer Sediment - Surface drainage along the west side of Plant 2 is directed to a storm sewer pipe at the west property line. Sampling of sediment collected along manholes indicated the presence of high lead (total and TCLP) concentrations. Discharge from the pipe is at Outfall 001.

- Surface Dusts - Sampling at two locations on the concrete surface indicate high concentrations of lead are present. These are likely associated with former plant operations and tracking of dusts by vehicular equipment.

Total estimated volumes of affected materials are as follows.

- TCLP Lead, >825 ppm lead, >25 ppm PCB materials sum to approximately 14,800± cu. yds. or 20,720± tons. the calculation of soil is wrong. *

- Materials >50 ppm PCBs sum to approximately 870±cu. yds (1,200± tons).

4-03. APPLICATION OF CORRECTIVE ACTION MANAGEMENT UNIT

In February 1993 the Environmental Protection Agency published regulations for Corrective Action Management Units (CAMU) in the Federal Register (58 FR 8683). A CAMU has been defined as an area within a facility that is designated by the Regional Administrator for the purpose of implementing corrective action requirements under RCRA. The regulation also presents the status of CAMUs in relation to existing RCRA regulations. ok

Several important features of the regulation make the CAMU concept applicable to the Roth Bros. corrective measure activities. Placement of remediation wastes into or within a CAMU does not constitute land disposal of listed hazardous wastes. Also consolidation or placement of remediation wastes into a CAMU does not constitute creation of a unit subject to minimum technology requirements. The facility definition used in the regulations includes all contiguous property under control of the owner.

Reasons for applying this concept to the Roth facility include the following:

- Operation of Roth Bros. secondary lead smelter after 1980 resulted in generations of K069 (lead baghouse dust) listed waste which was properly stored and disposed. It is unknown if the TCLP lead and total lead levels in soil, fill and sediment resulted from release of this dust. Therefore establishment of a CAMU would proscribe the issue of potential K069 designation.

- Establishing a CAMU would allow Roth to move contaminated soils/fill sediment from the SWMUs and AOCs to a central remediation area, rather than undertaking several dispersed treatment operations.

- The CAMU would allow Roth Bros. to treat wastes on site to specified criteria and then replace them on the site at a designated location. This reduces hazards from transport and maintains the problem on-site (rather than shifting to an off-site facility).

- The establishment of a CAMU provides Roth with a wider selection of remedies for the lead and PCB contamination on site since the CAMU addresses remediation wastes, treatment and potential placement on site.

All of these factors advance the regulatory purpose of the CAMU facilitating and enhancing the implementation of effective, protective and reliable corrective actions for the facility.

V. IDENTIFICATION OF CORRECTIVE MEASURE TECHNOLOGIES

This section reassesses the technologies for remediation identified in the Environmental Investigations performed by H&A (2) and identifies additional technologies which may be applicable to the Roth Bros. site. The purpose of the reassessment and identification is to eliminate those technologies that may prove infeasible to implement, are not reliable, or cannot achieve the corrective measure objectives set in Section IV within a reasonable time period.

5-01. SCREENING CHARACTERISTICS

Characteristics used to screen applicable from inapplicable technologies, based on the USEPA RCRA Corrective Action Plan guidance include:

- Site Characteristics - existing site conditions may limit or promote the use of certain remedial technologies. Where the site characteristics place such limitations, the technology is eliminated.

- Waste Characteristics - identification of the waste characteristics which limit the technology's feasibility or effectiveness.

- Technology Limitations - Limitations such as performance record, inherent construction, operation and maintenance problems, unreliability, poor performance, and methods which have not yet been fully demonstrated are characteristics considered during the technology screening process.

5-02. CORRECTIVE MEASURE ALTERNATIVES

The following corrective measure alternatives reviewed for this report have shown effectiveness in remediating lead and PCBs (with the exception of the No Action alternative which is included for baseline comparison). These technologies include:

1 • No Action
2 • Excavating and offsite disposal
3 • Cap/slurry walls
4 • Encapsulation
5 • Soil Washing
6 • Electrokinetic Leaching
7 • In-situ Vitrification
8 • Secondary Smelting
9 • In-situ solidification
10 • Ex-situ silicate solidification/stabilization
11 • Ex-situ polysilicate stabilization/mineralization

Section VI presents a description and evaluation of these alternatives.

VI. EVALUATION OF CORRECTIVE MEASURE OPTIONS

Screening of Corrective Measure Technologies (CMTs) presented in Section V identified a method for evaluating potentially applicable technologies for remediation of soil/fill and sediment at the Roth Bros. site. The purpose of this section is to further evaluate the technologies to recommend Corrective Measure Option(s) (CMOs) subject to final evaluation and selection. These CMTs are evaluated below based on criteria described in by the USEPA Corrective Action Plan guidance document. In addition, cost estimates for each CMT have been developed. A summary in Table III presents the relative evaluation of the alternatives in terms of the criteria. Unit cost estimates for the CMTs are also presented in Table III.

Specific criteria to which the CMTs were subjected are described below. Cost evaluation of basic alternative technologies (no action, excavate and disposal, cap, etc.) was based on Means Construction Cost Estimating or similar cost data, contacts with TSDFs and haulers. Information on more complex technologies was based on use of the USEPA Vendor Information System for Innovative Treatment Technologies (VISITT) data base and information from technology suppliers.

6-01. TECHNICAL CONCERNS

Technical concerns of alternatives evaluated on the possible CMT list include performance, reliability, and implementability.

- Performance - effectiveness in achieving the Corrective Action Objectives, and useful life (the length of time the level of effectiveness can be maintained) of the remedial option.

- Reliability - acceptable operating and maintenance costs and demonstration of consistent operation and effectiveness at similar sites.

- Implementability - ease of installation or implementation, time to install, and time to achieve significant contaminant reduction and/or treatment.

6-02. ENVIRONMENTAL CONCERNS

The environmental assessment of each alternative focuses on facility conditions and potential pathways of contamination. The review includes an evaluation of:

- short- and long-term beneficial and adverse effects;

- adverse effects on sensitive areas; and

- analyses of measures to mitigate adverse effects.

6-03. HUMAN HEALTH CONCERNS

The CMTs are evaluated in terms of:

- short- and long-term potential exposure to any residual contamination; and
- protectiveness of human health during and after implementation.

6-04. INSTITUTIONAL CONCERNS

Institutional concerns considered in evaluation of the CMTs are the potential effects of Federal, State and Local environmental and public health standards, regulations, guidance, advisories, ordinances or community concerns on the design, operation and timing of the alternatives. In addition, we have evaluated the technologies against the present and future business concerns of Roth Bros.

6-05. COST ESTIMATE

An estimate of the unit cost of each corrective measure alternative is evaluated. Capital and operation and maintenance costs (where appropriate) are developed.

6-06. NO-ACTION ALTERNATIVE

The no-action alternative would allow the lead/PCB contaminated materials to remain in place. No further steps would be taken to reduce the concentration of the components which render the material hazardous. Based on investigations conducted to date, there is no significant current threat to the site or public health. A potential threat exists based on an assumed child exposure scenario, however as indicated above, the nearest downwind property is another industrial facility and this exposure scenario is conservative. As discussed above, there is no evidence that the lead and PCBs are leaching the groundwater or have migrated off site. The affected areas are generally related to fill and the vicinity of a former baghouse dust storage area. Additionally, use of the Roth Bros. area is limited to storage of trailers and miscellaneous plant hardware, and public access is restricted. Thus, the material is not a significant threat to site personnel or public health.

TCLP lead has been detected at levels in limited areas exceeding the 5 ppm level used to define hazardous waste and PCBs exceed 50 ppm in limited areas. A no-action alternative would not satisfy the environmental concerns for disposal of these hazardous wastes.

This method would not reduce the possible toxicity, mobility, and/or volume of contaminated material. The cost of this option would be limited to continued site monitoring for detection of leached lead or PCBs in groundwater (approximately $15,000 to $25,000 per quarter). Further, with time, erosion of these materials to drainageways leading from the site may deteriorate existing conditions. This option would not require designation of a CAMU.

6-07. EXCAVATION ALTERNATIVE

The excavation alternative consists of the removal, hauling and disposal of lead and PCB contaminated soil/fill material at a permitted hazardous waste treatment facility. This method would result in the elimination of the toxicity, mobility and volume of hazardous materials from the site only. These concerns would then be managed at the treatment, storage disposal facility. Sampling of remaining soil/fill would be conducted for confirmation that this alternative meets or exceeds appropriate comparison criteria as discussed above (Section IV) and limited groundwater monitoring may be required beyond the removal action.

As the depths of the soil/fill material to be removed are technically feasible and are above the groundwater table, excavation activities could be implemented. Site disturbance and possible elevation of airborne lead concentrations during excavation and transport activities would make this alternative more difficult to implement and would require dust control measures such as water or calcium chloride application.

Costs associated with the excavation, off-site treatment alternative are estimated to be approximately $275-360/ton based on excavation, hauling and disposal costs estimated from Means and obtained from currently permitted haulers/disposal facilities. If groundwater monitoring is required during and for a period after the removal, the additional estimated O&M costs of $15,000 to $25,000 per quarter may result. This option would not require designation of a CAMU unless contaminated materials are consolidated for staging purposes.

6-08. ISOLATIVE/CAPPING ALTERNATIVES

This category of treatment technology assesses available options for the isolation of lead and PCB wastes. These technologies isolate the contaminated material from contact with precipitation, groundwater and human receptors.

6.8.1 Cap/Slurry Walls

The capping in-place alternative involves capping the existing ground surface in the affected areas. The capping process would cover the lead and PCB contaminated soil/fill material with a low permeability barrier thereby reducing the likelihood of contact with the contaminated material, and reducing the likelihood of migration via infiltrating groundwater or erosion of lead and PCB containing soil/fill. The affected area would also be surrounded by a low permeability slurry or grout wall to reduce migration potential via groundwater underflow.

Caps can generally be constructed over a relatively short time frame and are considered a reliable technology for sealing off contamination, thereby reducing the mobility of the affected materials. Long term maintenance would be required and would include the inspection of the cap's integrity for settlement, ponding of liquids (rainwater), and the presence of deep rooted vegetation which may degrade the cap. The implementation of a cap would not reduce the volume of contaminated material on site. Additionally, capping may limit the future use of the treated area, as once the cap is placed it must remain in place to be effective, and surface uses are usually limited to prevent cap breach.

Due to the scattered nature of the compounds across the site, some excavation and stockpiling to a single area to be contained and capped is recommended (would require a CAMU designation). A multi-layered cap over the approximate areas of lead and

PCB containing material is estimated to cost on the order of $36 to $44/ton for installation. Long-term groundwater monitoring would be associated with this alternative since no treatment to reduce leachability would occur. Annual costs for monitoring would be approximately $60,000 to $100,000.

There are concerns regarding the imposition of limits on future development of the site for commercial or industrial purposes, and the need for long-term monitoring. Reduction of the mobility of the contaminated material on site would be achieved only insofar as the material is and remains isolated. This option would require designation of a CAMU to be implemented.

6.8.2 Encapsulation

The encapsulation alternative involves excavation of the soil/fill material to a designated area on the site. The material would be placed over a bottom liner and sealed with a multi-layered cap, as described in Section 6.8.1. The excavated areas would require backfilling, compaction and grading.

This method would essentially fully encapsulate the affected material, thereby preventing the material from leaching to the groundwater. The volume and toxicity of the material would remain the same, however the mobility would be reduced through isolation of the affected materials.

As with the capping in-place alternative, there are concerns regarding the imposition of limits on future development of the site and the need for long term maintenance and monitoring. It is estimated the unit cost for the encapsulation method would be approximately $62 per ton. Monitoring costs would be approximately as described in Section 6.8.1. This option would require designation of a CAMU to be implemented.

How are costs arrived at? How does VISITT get its figures?

6-09. REDUCTION ALTERNATIVE

The reduction alternative category considers those technologies that act to reduce the total lead or PCB concentration in the site soil. A printout from the EPA VISITT software for this technology is included in Appendix B.

6.9.1 Soil Washing

The soil washing alternative involves excavating the contaminated soil, separating the particles by size, and then applying a combination of physical (scrubbing, pressure, heat jets) and chemical (pH adjustment, oxidation) steps. Since inorganic contaminants tend to bind to clay-and silt-sized soil particles the physical and chemical separation accomplished by the washing concentrates the contaminants into a smaller volume of soil.

Mobil units for soil washing operations are available and could be set up on the Roth Bros. site. Contaminated materials would be excavated as described in Section 6-07. Mixed waste, such as a combination of organics with metals (ie. lead and PCBs), make the washing fluid formulation difficult. EPA has rated the applicability of this technology as moderate to marginal for PCB contamination and moderate to marginal on silty/clay soils with metal contamination. This alternative would reduce the volume of contamination by separating and concentrating the contaminants in a smaller volume. Toxicity would likely be reduced for the treated volume but would be higher for the high concentration smaller volume. Mobility is not necessarily addressed since the leachability and chemical state of the treated volume is not known. Technology studies predict a 80-90% reduction in waste volume, resulting in a lower volume (10 to 20% of original), higher concentration waste. Additional treatment (off-site treatment and/or destruction) would be required for the reduced waste volume. Thus this alternative must be considered in combination with off-site treatment and disposal. Further, washing is not applicable to the TCLP-lead material so additional measures would be required for site wastes with this characteristic.

Costs for the implementation of this alternative depends on the type of wash fluid required. The EPA VISITT software estimates the cost at $50-$150/ton for the total volume to be treated. An additional $275-360/ton (off-site disposal cost) would likely apply to the reduced volume, high concentration material. TCLP and PCB wastes would require additional expenditures for treatment by other methods. This option would also require designation of a CAMU or treatment unit (TU) to be implemented.

6.9.2 Electrokinetic Leaching

The electrokinetic leaching alternative is an emerging technology for reduction of metal contamination in soil. Electrokinetic soil processing is an in-situ, semi-continuous technology that electrically induces migration of heavy-metal ions. A low intensity direct current is applied across the contaminated soil. This is a cyclic application that takes two to three months per cycle, based on treatment of homogeneous material. Developers of the technology predict a 75 to 95% reduction in metal concentration across the most highly affected treatment area during the first cycle. The status of this technology is bench/pilot study only. This technology is featured in the VISITT software, a printout is included in Appendix B.

Technology developers indicate this alternative will suffer a loss in removal efficiency when applied to a site that has a mixture of metal and organic contamination. Environmental and human health concerns may occur due to possible volatilization of PCBs. Since this technology induces migration, the mobility of the waste would be increased, possibly moving contaminants through previously uncontaminated areas. Volume and toxicity would be decreased as the lead migrates to the removal point. This technology is considered to require a long operating period to achieve the site goals if materials to be treated are non-homogeneous. Further, it does not change TCLP characteristics so additional treatment would be required for this and PCB treatment.

Since this alternative is considered an emerging technology, it is difficult to foresee the level of effort required to implement the program. The developer estimates the cost of implementation to be $90 to $140/cubic yd. Costs can be significantly affected by higher contaminant concentrations and/or heterogenous waste mixtures since more cycles (greater electrical costs) would be required. Additional methods of treatment and costs would be required for TCLP and PCB wastes. It is assumed that monitoring costs would apply during and perhaps shortly after treatment at the estimated annual cost described above. This alternative would not require designation of a CAMU to be implemented but would be enhanced through such designation (to allow waste consolidation at a treatment location).

6-10. IMMOBILIZATION ALTERNATIVES

This category of alternatives includes technologies which act to secure lead and PCB contamination to the soils where they are presently contained. Since several site locations have failed a TCLP lead test, the leachability of contaminants must be addressed by the CMT. The technology must protect site groundwater from future contamination.

6.10.1 In-Situ Vitrification

In-situ vitrification alternative involves the use of electrical networks to melt soil or sludge at temperatures ranging from 1600° to 2000°C. The process results in immobilization of inorganic pollutants (metals) and PCBs. The soil volume is typically reduced by 20-40% by elimination of void space and ignition/oxidation through low temperature burns. A silicate glass and microcrystalline structure remains as the vitrified soil waste material. Backfill is placed over the vitrified material. This technology is featured in the VISITT software and a printout is included in Appendix B.

This method would reduce the mobility and volume of the affected soil/fill materials. In addition, this method is considered to be effective over the long term for both the leachable lead and PCBs.

A developer of this technology estimated costs associated with treatment range from approximately \$310/ton to \$360/ton. Actual costs per ton would be determined following a review by the development contractor to determine applicability for existing site conditions. It is assumed that monitoring costs would also apply during treatment (assuming one to two years, these range from \$60,000 to \$200,000). This alternative would not require designation of a CAMU to be implemented but would be enhanced through such designation (to allow waste consolidation at a treatment location).

6.10.2 Secondary Smelting

The secondary smelting alternative is otherwise known as slagging with off-gas treatment. During this process waste is injected into a hot (2,200 - 2,500°C) reducing flame in the reactor section of the burner. The control of operating parameters allows extraction of valuable metals and destruction of hazardous organics. Metals such as lead are vaporized from the waste along with volatile compounds. The reactor feeds into a slag separator where process gases are separated from molten materials. The slag is continuously solidified and removed. Off-gas vapors are post-combusted with ambient air and condensed as metal oxides. The mixed metal oxide particulate is collected in a baghouse. Secondary smelting is also featured on the VISITT software. Appendix B contains a printout.

Check with ATTIC

ask Chris for his computer

This technology would require site excavation but it would otherwise reduce the toxicity, mobility and volume of waste materials. Environmental concerns related to air emissions must be satisfied by the use of baghouse collectors and scrubbers.

To implement this technology at the Roth site, excavation of contaminated soils would be followed by a pretreatment to reduce the moisture and size of excavated material. The developer of this technology suggests that the metal concentration in the waste be greater than 5% in order to produce a metal product suitable for recycling. None of the areas sampled to date have exhibited such values (50,000 ppm), therefore this technology would likely not be applicable to the majority of the site. Further, the unusable residue from the process would still be a waste requiring treatment/disposal. This method would be enhanced by designation of a CAMU to allow on-site treatment and placement of the waste residues. Predicted costs for this technology would range $150 to $300/ton, not including mobilization and probable electrical upgrade required. Costs for residue waste disposal are also not included.

6.10.3 In-Situ Solidification

The in-situ solidification method involves treating the soil/fill material in-place using a large diameter (3 to 12 ft.) single mixing auger. A solidification product, consisting of a cement-organic clay mix, is injected and mixed with the soils. The procedure continues in an overlapping circular pattern over the affected areas. The overall bulk density of treated soil/fill is increased by approximately 21%, and the end product is a low porosity, dense, homogeneous mass of soil/fill. This method is reported to be effective in stabilizing the leachable lead and PCBs without having to excavate the soil, thereby reducing mobility. The toxicity of the affected materials would also be substantially reduced since exposure routes (inhalation, ingestion) are eliminated or reduced.

Costs associated with this in-situ solidification method are estimated to be $195/ton. A pilot scale test would be required to determine site-specific applicability and actual unit cost per ton. Since this technology is intended to be applied in-situ, selected areas of the site may be more difficult to treat or close due to surface uses, resulting in slightly higher costs. Further, it is assumed groundwater monitoring may be required through the period of corrective action. This alternative would not require designation of a CAMU to be implemented but would be enhanced through such designation (to allow waste consolidation at a treatment location).

Groift first visit

6.10.4 Ex-Situ Silicate Solidification/Stabilization

The silicate solidification/stabilization alternative involves the solidification and stabilization of excavated soil/fill materials. The affected material is excavated, mixed with silicates and a cementatious material on-site and then cast into molds for on-site or off-site disposal.

This method is applicable to soils and sludges with heavy metals and high molecular weight organics (i.e. PCBs). The wastes are immobilized and bound into a hardened, concrete-like solidified mass. The volume of the treated material will be approximately 50% greater than the original contaminated soil.

This method would reduce the toxicity and mobility of the affected soil/fill materials (as above). In addition, the silicate stabilization method is considered to have long-term effectiveness for both the leachable lead and presence of PCBs.

Developers of this method estimate costs associated with treatment to be $75-$105/ton. Actual unit costs per ton would be determined following a pilot-scale test to determine the applicability for the site conditions. Again, it is assumed additional costs for monitoring would apply through the period of treatment. A CAMU designation would be required for this method.

6.10.5 Ex-Situ Polysilicate Stabilization/Mobilization — mineralizing? spelling.

The polysilicate stabilization/or an equivalent mineralization alternative is similar to the silicate solidification/stabilization, but the technology does not form a solidified monolith. Contaminated materials are excavated and processed on site. Heavy-metals contaminated soils are wetted with a polysilicate water mixture and/or other proprietary reagents that convert metal oxides to metal metasilicate or lead phosphate (apatite crystal) mineral structure. Small amounts of a cementatious material are added and the resulting material is cured for a period of time determined from treatability testing. The treated material is friable and may be backfilled and recompacted with conventional earthmoving equipment, and remains workable over the long term.

As above, this technology reduces the toxicity and mobility of lead and PCBs. The treated material has a volume increase of approximately 10%. If mineralization is used, typically there is no increase or a slight decrease in volume of the treated material.

The polysilicate stabilization/mineralization technologies are mobile operations which would be relatively easy to implement at the Roth Bros site. The developers of this technology estimate the costs of implementation to be $40 to $80/ton. Again, monitoring costs would also apply through the period of treatment. A CAMU designation would be required to allow effective implementation of this alternative.

6-11. ALTERNATIVE SCREENING RESULTS

The technologies listed above have been screened relative to the criteria determined by USEPA's Corrective Action Plan guidance. The results of this analysis are shown in Table III. There are many alternative remediation technologies which will prevent the leaching of lead and PCBs to groundwater, however, some of these technologies were disqualified based on the ease of implementability and time to remediate.

Several of the alternatives reviewed were disqualified because they would not achieve the site remediation goals. The no action alternative does not address the >5 ppm TCLP lead detected on site. The soil washing technology was eliminated due to the prediction that the technology would not meet TCLP or PCB criteria and may not be effective on the range of grain sizes and debris present in affected soil/fill at the Roth site. Electrokinetic leaching is still considered an emerging technology developed only to a pilot study stage with the same drawbacks as soil washing. Also, the electrokinetic leaching technology would need to be applied to Roth soils in several cycles making the prediction of remediation time difficult to determine.

Also removed from further consideration was the secondary smelting alternative. The purpose of the technology is to recover a recyclable grade of metal. Since the majority of Roth site soils have less than 5% by weight lead content, this technology is not viable.

Excavation with off-site disposal is contrary to NYSDEC waste-minimization goals. The excavation and off-site disposal option does not remediate the soil, it simply relocates the hazard to another location. must follow up

Selected technology alternatives (cap, encapsulation, vitrification, solidification) were disqualified even though they met the technical and environmental goals of preventing leaching to groundwater. The reasoning behind elimination of these technologies was based on an evaluation of their long-term effectiveness and their impact on future site use.

The isolation alternatives, cap with slurry wall and encapsulation, are both protective of groundwater under the site. The caps will have to be maintained in order to protect the integrity of the technology. Capping or encapsulation would restrict the property available to Roth Bros. for future business activities. The in-situ vitrification and solidification alternatives would remain effective over the long term in protecting groundwater, but would severely limit the possible future expansion of the Roth site facilities.

Ex-situ silicate solidification/stabilization will be protective of groundwater and prevent the occurrence of lead contaminated respirable dusts. This technology was disqualified because it generates a large increase in volume. This fact, plus the monolithic nature of the remediated soil, make the implementation of this technology less favorable from a future site use perspective.

Ex-situ polysilicate stabilization/mineralization provides the necessary protection to groundwater resources and on-site/off-site human and environmental receptors. The application of this technology increases the soil volume by approximately 10%, or causes no volume increase if mineralization is used. The resulting metasilicate (or phosphate mineral) and soil mixture is friable and can be backfilled, compacted and contoured much like the native soils. This remedy will preserve the option of site expansion for Roth. OK

The polysilicate stabilization technology alone significantly reduces, but does not eliminate the ingestion exposure route, therefore some limited capping or administrative controls on future site use may be needed. Further, as discussed previously, the >50 ppm PCB materials must be removed from the site. In summary, the results of the evaluation of the possible treatment alternatives is that ex-situ polysilicate stabilization or equivalent mineralization in combination with removal of >50 ppm PCB wastes and limited capping best satisfies the evaluation criteria. These CMOs will do the following:

1) Eliminate the TCLP characteristic waste.
2) Prevent leaching and reduce toxicity and mobility of >825 ppm lead and >25 ppm PCB material.
3) Eliminate exposure routes that constitute the risk concerns for >825 ppm lead and >25 ppm PCB materials.

A further evaluation of these technologies, specific to the site, is presented in Section VII.

VII. JUSTIFICATION AND RECOMMENDATION OF CORRECTIVE MEASURES

This section further details the evaluation of the ex-situ polysilicate stabilization technology for application at the Roth Bros site. Initial detailed evaluation is against technical criteria described by USEPA Corrective Action Plan guidance. Additionally, the technology is evaluated relative to satisfying the goals of creating a CAMU on the site, as described by the 2/16/93 Federal Register CAMU listing.

7-01. TECHNICAL CRITERIA

The selected technology alternative was reviewed against four technical criteria; performance, reliability, implementability and safety.

7.1.1 Performance

Performance of the evaluated technology is measured by the degree to which the technology reduces the possibility of lead and PCBs leaching to the groundwater, reduces exposure of on-site and off-site receptors via airborne dust particles containing lead, and reduces exposure via ingestion.

An ex-situ polysilicate stabilization process (otherwise known as the Trezek Method) is available from Greenfield Environmental/Solid Treatment Systems (STS) Division. STS has performed a treatability study on samples taken from the Roth Bros site.

Treatability studies are performed to develop the appropriate method to eliminate or minimize the concentrations of hazardous materials. The treatability study establishes such factors as appropriate polysilicate mixture for the wastes, the applicability to the site specific soils, and cost information. Two five-gallon buckets of soil were collected from the Plant 2 northern fill area. The sample locations were identified as B-1 and B-2 for analyses were selected from locations of B250 and TP202, respectively. Each sample was obtained by lining a pail with a clean polyethylene soil sample bag. The upper 3 in. of soil was scraped from each location, and soil from 3 to 18 in. depth was excavated with a clean shovel, piled adjacent to the hole and blended before placement into the bag. The bags were then sealed, labeled and stored in the H&A of New York rock and soil laboratory until shipment to STS, Inc.

In addition, a sample of lead flue dust collected by Roth Bros. personnel in a clean Nalgene container provided by Roth Bros. This sample was also stored in the H&A laboratory.

Prior to submitting the samples to STS, Inc. for the treatability study, H&A mixed a predetermined amount of the lead flue dust with sample B-2 to provide a spiked sample representation of high TCLP conditions. A split (labeled as B-2S) was collected and submitted to an independent laboratory (General Testing Corporation) for TCLP lead analyses. Samples B-1 and B-2 were then shipped on to STS, Inc. in California for the treatability study.

The results of the treatability study (refer to Appendix C) indicate the soil/fill material can be stabilized with the STS proprietary reagents at a cost within the range presented for the technology. TCLP tests were used as a measure of the potential of toxic constituents to leach from a waste to contaminate the groundwater. The initial concentration for sample B-2 was 50.15 ppm by a TCLP test. The post-treatment sample was analyzed and found to contain 0.06 ppm of TCLP lead. This indicates a 99% reduction in leachable lead content.

The ex-situ polysilicate stabilization process also increases the average size of soil particles by a minimum of 10%. This increase in average particle size decreases the number of particles subject to air entrainment as respirable dust, thereby significantly reducing the inhalation exposure route. Encapsulation of lead compounds in the final metal metasilicate makes the final product less toxic (by ingestion) by limiting the bioavailability of the lead. Total lead concentrations are not reduced, therefore even though the stabilized lead is less bioavailable, an ingestion route would not be eliminated unless the treated area received a minimal cap. a 10% chang in size would have a very small effect on dispersion.

? 10% or a factor of 10?

7.1.2 Reliability

The reliability of the chosen corrective measure is judged by evaluating the operating and maintenance requirements of the process. The ex-situ polysilicate stabilization process does not require any on-going maintenance activities to be reliable. Once the material has been stabilized it is cured in small piles on-site. The cured material is analyzed and used to backfill the formerly contaminated soil excavations. When this operation is complete at all site areas requiring remediation, the process unit is broken down and removed from the site. The only periodic monitoring anticipated would be that required to support closure of the CAMU(s) necessary to perform this on site (see below). This and similar mineralization processes have been performed at several sites to date and have demonstrated reliability of implementation and performance.

7.1.3 Implementability

The selected corrective measure should be relatively easy to construct and implement, reducing the contamination in a timely manner.

The polysilicate stabilization and mineralization technologies have been successfully applied to a number of sites. A summary of implementation procedures and operation at a representative heavy metals treatment site is described in Appendix D for the polysilicate stabilization. We anticipate the operation of the Roth corrective measure would cycle through the excavation, sorting, treatment (stabilization), curing and backfilling steps in an efficient manner. By selecting the polysilicate stabilization technology, the site avoids continuing operations and maintenance costs that may be associated with other technologies.

In summary, the STS polysilicate stabilization (or equivalent by other vendors) meets these criteria. STS has developed a mobile self contained system for applying the technology that is anticipated would be used at Roth Bros. if STS is the selected vendor.

7.1.4 Safety

The selected corrective measure must satisfy the criteria of maintaining the safety of on-site and off-site persons. Equipment for the stabilization/mineralization methods involve conventional earth moving and handling machinery (wet screens, blenders, pugmill, etc.) thus safety measures are relatively easily defined and implemented. Since the treatment is wet, dust control measures are limited to those needed for initial excavation.

Site excavation requirements have been reviewed with Roth, and their representatives indicate excavation can be sequenced to allow safe conduct of ongoing site operations.

7-02. HUMAN HEALTH

The corrective measure selected for the Roth Bros site must satisfy the criteria of being protective of human health.

On site lead contamination has been detected in soils, but not in groundwater. The lead on site has also been shown to have the potential of leaching to groundwater (via TCLP analysis). Although groundwater is not presently and not anticipated to be used for a drinking water source, the polysilicate stabilization/mineralization processes protect human health in this respect by reducing the leachability of lead, thereby protecting the groundwater resource.

As described in the USEPA Uptake/Biokinetic Model, lead impacts are best determined by evaluating effects on blood lead levels. The model shows that many different lead sources (i.e. drinking water, paint) contribute to the total body burden. The site-specific evaluation performed for this CMS determined that lead containing dust particles transported by air movement across the Roth site potentially can contribute to human lead body burdens, if the site was not remediated. The STS stabilization technology increases the size of the treated particles by a minimum 10% making them significantly less mobile, and decreasing their ability to become airborne particles transported off-site. The particle size increase will also restrict the availability of dust particles of a respirable size to on-site personnel. ?

Toxicity of the treated material is reduced by the decrease in bioavailability of the treated material. However, once treated and replaced on site the ingestion route of exposure would not be eliminated by the STS method. To do this contact with the treated material need only be eliminated. A minimal cap (pavement, building, or minimal soil cover and vegetation) or limited administrative controls to control access would satisfy this criteria. This would be implemented best by consolidating the treated material to allow controlled final placement, grading for drainage to controlled run-off points (such as existing SPDES outfalls), and control of future access.

7-03. ENVIRONMENTAL

Satisfaction of the environmental criteria is measured by the corrective measures ability to cause the least adverse impact or greatest improvement over the shortest period of time. The polysilicate stabilization or equivalent mineralization meets these environmental goals.

Application of the process is not anticipated to cause adverse effects on environmental receptors. The area of operation for the treatment unit would be industrial. Activities associated with the treatment unit would not be significantly different than those already conducted on site.

Removal of the contaminated sediments from outfall areas for treatment and backfill on-site would limit any further transfer of contamination toward off-site locations from the outfalls. This would be a net positive environmental benefit. Similar to the benefit expected for human health, a decrease in lead containing dust transported off-site will benefit potential environmental receptors.

The polysilicate stabilization or equivalent mineralization will prevent the leaching of lead into groundwater; protecting those resources, and preventing migration of contaminants off-site.

7-04. CAMU OBJECTIVES

The CAMU concept, as introduced in Section 4-04, has specific requirements for its application. This section summarizes how the creation of a CAMU on the Roth Bros site will facilitate the application of the selected corrective measure, ex-situ polysilicate stabilization. Variance from selected requirements of 6NYCRR Parts 373 and 376 are required for designation of a CAMU. A petition for variance, providing more detailed discussion of the following CAMU criteria, appears in Appendix E.

Establishment of a CAMU must satisfy the following seven criteria (Federal Register dated 16 February 1993):

1) **CAMU shall facilitate reliable, effective, protective, and cost-effective remedies.** These factors have been discussed in Sections VI and 7-01 through 7-03 of the CMS. The polysilicate stabilization or equivalent mineralization satisfies those criteria and treatment is enhanced through designation of a CAMU. Although polysilicate stabilization, and limited capping if required, do not constitute the lowest unit cost alternative(s), they constitute the most implementable, reliable and cost-effective. Further it meets the criteria for site protectiveness.

2) **CAMU shall not increase risks during remediation.** This criteria is addressed above at Sections 7-02 and 7-03.

3) **CAMU shall be placed in uncontaminated area only if remediation waste management at such a location will be more protective.** Placement of stabilization-treated materials at one, controlled location within a CAMU enhances Roth's ability to control future access and prevent contact. This can only be accomplished by designation of a CAMU and limited placement over currently uncontaminated areas. The CAMU should be located primarily over the northern fill area (SWMU 49) thereby minimizing, as much as possible, placement on uncontaminated areas.

4) **CAMU shall be monitored and maintained to minimize future releases.** The entire set of corrective measures recommended (remove >50 ppm PCBs; stabilize, consolidate and place TCLP lead, >825 ppm lead, >25 ppm; place a limited cap) minimizes the potential for future release. Monitoring would be required during treatment to determine effectiveness and for a short-term following remediation to determine no change in groundwater conditions. what about long term?

5) **CAMU shall expedite timing of remedial implementation.** The timing of the stabilization/mineralization will be more fully outlined in a Corrective Measures Implementation Plan. However, the technology has been shown to be able to treat soils at up to 100 tons per hour. Treatment of the Roth soils targeted for remediation by the polysilicate stabilization should be accomplished in a time-efficient manner, estimated at approximately 4 to 6 weeks for all field work.

6) **CAMU shall enhance the long-term effectiveness of the selected remedy.** This criteria is satisfied as described in Section VI and 7-01 to 7-03. Further, a CAMU designation provides the best mechanism for future access control and therefore effectiveness.

7) **CAMU shall minimize land areas where wastes remain in place.** As shown on Figure 2, the affected areas are dispersed at several locations on the Roth Bros. Plant 2 property. Designation of a CAMU would allow consolidation of these materials to a single location.

The selected corrective measure requires the creation of a CAMU in order to be implemented and allows a better final corrective measure through performance under a CAMU designation on the Roth Bros. site. The ex-situ polysilicate stabilization or equivalent process will be most protective, effective, and cost effective if the treated soils can be backfilled on-site in a designated CAMU.

Since the technology is a mobile unit it is best suited to be operated at the location of contamination. There are several areas of the site which require corrective action. Bringing contaminated soils to a central remediation area (CAMU) located at the northern fill area (see Figure 2) will facilitate the operation of the polysilicate stabilization or equivalent process. As material is processed and cured it may be backfilled into site excavations allowing for a minimum of soil piles on site and a minimum of site business interruption.

Further specifics of the application of the CAMU should be detailed in the Corrective Measures Implementation Plan. That document should also contain specific plans for CAMU closure monitoring provisions.

In summary, it is concluded and recommended that Corrective Measures to be implemented at the site include:

1. Removal and proper off-site disposal of wastes with >50 ppm PCBs. The approximate volume of these materials is estimated to be 870± cu. yds (1,200± tons); cost of this is estimated to be approximately $275 to $360/ton.

$75?

2. On-site polysilicate stabilization of TCLP lead wastes (>5 ppm), total lead materials >800 ppm, and remaining PCB materials >25 ppm. Greenfield/STS as a provider has performed a treatability study specific to the site materials and can achieve results that acceptably meet site CMOs. Estimated volumes to be treated are 14,800± cu. yds. (20,720± tons) at estimated costs of $58±/ton for the STS treatment. Other vendor costs range from $40 to $80/ton.

3. Placement of treated material in a designated CAMU with a limited cap (building, pavement or other) to control runoff access and long term effectiveness. The estimated area that may require final cap is approximately 66,500 sq. ft. (1.5± acres). Alteratively, placement with limited grading, topsoil and seeding, and limited administrative controls to control access could accomplish the same objectives. The consolidated placement area (CAMU) should be located to the maximum extent possible, over the existing contaminated northern fill area (see Figure 2) in order to comply with CAMU designation criteria. calculate

These recommendations should be carried forward into Corrective Measures Implementation (CMI) design and, upon approval implemented at the site. The CMI design should also summarize specific cost estimations, once design features are better defined.

SOURCES OF INFORMATION

1. "Environmental Investigations, Roth Bros. Smelting Corp. - Plant 1, East Syracuse, New York". H&A of New York, May 1991.

2. "Environmental Investigations, Roth Bros. Smelting Corp. - Plant 2, East Syracuse, New York", H&A of New York, May 1991.

3. H&A of New York telephone conversation with Mr. Paul Patel, NYSDEC, 29 April 1992.

4. Letter to NYSDEC: Response to Review by NYSDEC, H&A of New York, 10 February 1992.

5. "Draft Phase II RCRA Facility Assessment Report for the Roth Bros. Smelting Corp., East Syracuse, New York, EPA I.D. No. NYD006977006", A.T. Kearney, Inc., October 1991.

6. Letter to USEPA: "Draft Phase II RCRA Facility Assessment Review", H&A of New York, 10 April 1992.

7. "Work Plan for Remaining RCRA Facility Investigation Activities, Roth Bros. Smelting Corp., East Syracuse, New York" H&A of New York, October 1992.

8. "Summary of HWMU Closure Activities, Roth Bros. Smelting Corp., East Syracuse, New York" H&A of New York, October 1992.

9. Lead Contaminated Soil Cleanup Draft Report, Ciriello, P.L., and T. Goldberg, USEPA Region I, 27 March 1987.

10. Users Guide for Lead: A PC Software Application of the Uptake/Biokinetic Model Version 0.50. ECAO-CIN; OHEA; U.S. Environmental Protection Agency. January 1991; and Technical Support Document on Lead. ECAO-CIN-757; U.S. Environmental Protection Agency. January 1991.

11. Agency for Toxic Substances Disease Registry (ATSDR) 1989, Toxicological Profile for Selected PCBs (Aroclor-1260, 1254, 1248, 1242, 1232, and 1016).

12. Onondaga County Health Department Lead Poisoning Control Program. 1990 Summary of Children with Abnormal Blood Lead Levels (by Census Tract).

13. Revised Guidance on Establishing Soil Lead Cleanup levels at CERCLA Sites and RCRA Facilities. DRAFT. OSWER, U.S. Environmental Protection Agency. 4 June 1992.

14. Total Suspended Particulate (TSP) Airborne Concentrations at Construction Sites. Transportation Research Board (1978).

Appendix C?

FOIL206649

15. Meadows SD et al. Risk Evaluation of Lead in Soil and Groundwater at the H. Brown Superfund Site in Walker, Michigan. In: Superfund Risk Assessment in Soil Contamination Studies. Ed: Keith B. Hoddinott. ASTM Publication Code Number (PCN) 04-011580-38.

16. Pasquill, F. 1961. The estimation of the dispersion of windborne materials. Meterol. Mag. 90, 1063, 33-49. As reviewed in: Turner DB. 1970 Workbook of atmospheric dispersion estimates. Research Triangle Park, NC. U.S. Environmental Protection Agency, Office of Air programs. AP-26.

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Tables

TABLE I
ARITMETIC AND GEOMETRIC MEAN DETERMINATION
FROM SOILS ANALYTICAL DATABASE

NEAR SURFACE VALUES (0-2 FT.)

Sample Location	Sample No.	Total Lead (ppm)	Ln
Paved Fill Area North of Plant 2	B201-S1A	105	4.654
	B201-S1B	63.2	4.146
	B241-S1	2.5	0.916
	B250-S1	15000	9.616
	B251-S1	3570	8.180
	B252-S1	147	4.990
Baghouse/Scrap Storage Area	B264-S1	29600	10.296
	B265-S1	2.5	0.916
	B266-S1	30	3.401
	B268-S1	64	4.159
	B269-S1	2.5	0.916
Fill Area	B278-S1	752	6.623
LBS-3 Area	B282-S1	1850	7.523
	B283-S1	2650	7.882
	B284-S1	1530	7.333
	B285-S1	3740	8.227
Stormsewer Discharge	SDS-1-6	26500	10.185
	SDS-1-7	35700	10.483
	SDS-1-8	41500	10.633
Outfall 001 (SWMU No. 45)	SDS-1-101	5030	8.523
Outfall 003 (SWMU No. 39)	003-1 (0'-1')	4200	8.343
Fill Area (SWMU No. 29)	B303-S1	4870	8.491
	B304-S1	3500	8.161
	B305-S1	3010	8.010
	B306-S1	449	6.107
	ARITHMETIC MEAN	7355	6.749
	GEOMETRIC MEAN		852.847
	STND. DEVIATION	11960	2.93
	COEF. OF VAR.	1.63	0.43

NOTE: COEFFICIENTS OF VARIATION GREATER THAN 1.00 INDICATE THAT THE DATA ARE NOT NORMALLY DISTRIBUTED.

SAMPLES GREATER THAN 500 PPM

Sample Location	Sample No.	Total Lead (ppm)	Ln
Paved Fill Area North of Plant	B202-S1	575	6.354
	B206-S1	2240	7.714
	B210-S1A	557	6.323
	B210-S1B	6940	8.845
	B215-S1	6220	8.736
	B219-S1	2370	7.771
	B220-S1	3740	8.227
	B225-S1	9730	9.183
	B228-S1	10300	9.240
	B239-S2	1280	7.155
	B243-S1	40000	10.597
	B243-S2	56500	10.942
	B245-S1	14700	9.596
	B250-S1	15000	9.616
	B251-S1	3570	8.180
Baghouse/Scrap Storage Area	B264-S1	29600	10.296
	B274-S1	2980	8.000
Fill Area	B278-S1	752	6.623
	TP201-J1	563	6.333
LBS-3 Area	B282-S1	1850	7.523
	B283-S1	2650	7.882
	B284-S1	1530	7.333
	B285-S1	3740	8.227
Stormsewer Discharge	SDS-1-6	26500	10.185
	SDS-1-7	35700	10.483
	SDS-1-8	41500	10.633
Outfall 001 (SWMU No. 45)	SDS-1-101	5030	8.523
	SDS-1-102	7000	8.854
	006 (SDS-1-102 Dup)	8720	9.073
Outfall 002 (SWMU No. 46)	SDS-2-102	7350	8.902
Outfall 003 (SWMU No. 39)	003-1 (0'-.1')	4200	8.343
Fill Area (SWMU No. 29)	B303-S1	4870	8.491
	B304-S1	3500	8.161
	B304-S2	745	6.613
	B305-S1	3010	8.010
	B305-S2	3210	8.074
	ARITHMETIC MEAN	10242	8.47
	GEOMETRIC MEAN		4785.26
	STND. DEVIATION	13615	1.26
	COEF. OF VAR.	1.33	0.15

NOTE: COEFFICIENTS OF VARIATION GREATER THAN 1.00 INDICATE THAT THE DATA ARE NOT NORMALLY DISTRIBUTED.

FILE NO.

TABLE II
ROTH BROTHERS CORPORATION - PLANT 2
MODELING OF LEAD EXPOSURES FROM EXPOSED SOILS
FILE NO. 70185-43

EXPOSURE SCENARIO	AIRBORNE LEAD CONC. (UG/M3)	LEAD SOIL LEVELS (UG/GM;PPM)	BLOOD LEAD CONC. (UG/DL)	PROBABILITY
ON-SITE:				
WORST-CASE	0.545	750	5.33	96.65
		800	5.53	95.85
		825*	5.62	95.21
		850	5.72	94.86
MORE-LIKELY CASE	0.261	750	5.27	96.88
		800	5.47	96.13
		825	5.57	95.54
		850*	5.67	95.21
		875	5.77	94.48
PROPERTY BOUNDARY:				
WORST-CASE	0.211	800	5.46	96.13
		825	5.56	95.54
		850*	5.66	95.21
		875	5.76	94.48
MORE-LIKELY CASE	0.101	800	5.44	96.13
		825	5.54	95.85
		850*	5.64	95.21
		875	5.74	94.86

ROTH

NOTES:

1. Blood lead concentrations are geometric means calculated using the U.S. Evironmental Protection Agency Uptake/Biokinetic Model for Lead (Version 0.5).
2. * Soil lead levels which are unlikely to produce blood lead levels greater than 10 ug/dl in more than 5% of the children exposed.

TABLE III
ROTH BROS. SMELTING CORPORATION

Technology Alternative	ALTERNATIVE ASSESSMENT CRITERIA: TECHNICAL				ENVIRONMENTAL				HUMAN HEALTH		INSTITUTIONAL		COSTS	REMARKS
	Effectivness	*Useful Life*	*Reliability*	*Implementability*	*Limits Contamination Pathway*	*Prevents Adverse Effects*	*Short Term Benefit*	*Long Term Benefit*	*Mitigates Short Term Exposure*	*Mitigates Long Term Exposure*	*Business Concerns*	*Community Concerns*		
No Action	□	□	□	●	□	□	□	□	□	□	◘	□	$0	This alternative not viable because of >5 ppm TCLP lead
Excavation	●	●	●	◘	●	●	●	◘	●	●	□	◘	$275-360/ton	This alternative is most disruptive to site and contrary to waste minimization.
Cap with Slurry Wall	◘	◘	◘	●	●	●	●	□	●	◘	◘	●	$35-45/ton	This alternative requires maintenance and monitoring.
Encapsulation	◘	◘	◘	◘	●	●	●	□	●	◘	□	●	$65/ton	This alternative requires maintenance and monitoring.
Soil Washing	◘	●	●	●	◘	◘	●	●	●	●	●	●	$50-150/ton	This alternative needs to be applied in combination with another technology.
Electrokinetic Leaching	●	●	●	□	□	◘	◘	●	□	●	◘	◘	$90-140/ton	This alternative requires long period to apply. *Also is still in* pilot phase.
In-Situ Vitrification	●	●	●	□	●	●	●	●	●	●	□	●	$310-360/ton	This alternative limits future site use.
Secondary Smelting	●	●	●	□	●	●	●	●	●	●	□	●	$150-300/ton	Material should be greater than 5% metal concentration to make recovery feasible. Process residue would require haz. waste disposal.
In-Situ Solidification	●	◘	◘	□	●	●	●	●	●	●	□	●	$195/ton	This alternative limits future site use.
Ex-Situ Silicate Solidification/ Stabilization	●	●	●	◘	●	●	●	◘	●	●	□	●	$75-105/ton	This alternative increases volume by 50% and results in cast concrete-like masses.
Ex-Situ Polysilicate Stabilization/Mineralization	●	●	●	●	●	●	●	●	●	●	●	●	$40-80/ton	This alternative increases volume by 10% and results in friable, backfillable material.

KEY
- ● - Technology satisfies criteria.
- ◘ - Technology marginally satisfies criteria.
- □ - Technology does not satisfy criteria.

Note:
All costs are estimated based on developer's data.

VBD:gmc:70185-43:table3.wp

Figures

N

QUADRANGLE LOCATION

USGS QUADRANGLE: SYRACUSE EAST, N.Y.

H & A of New York

Consulting Geotechnical Engineers, Geologists and Hydrogeologists

ROTH BROS. SMELTING CORP.
EAST SYRACUSE, NEW YORK

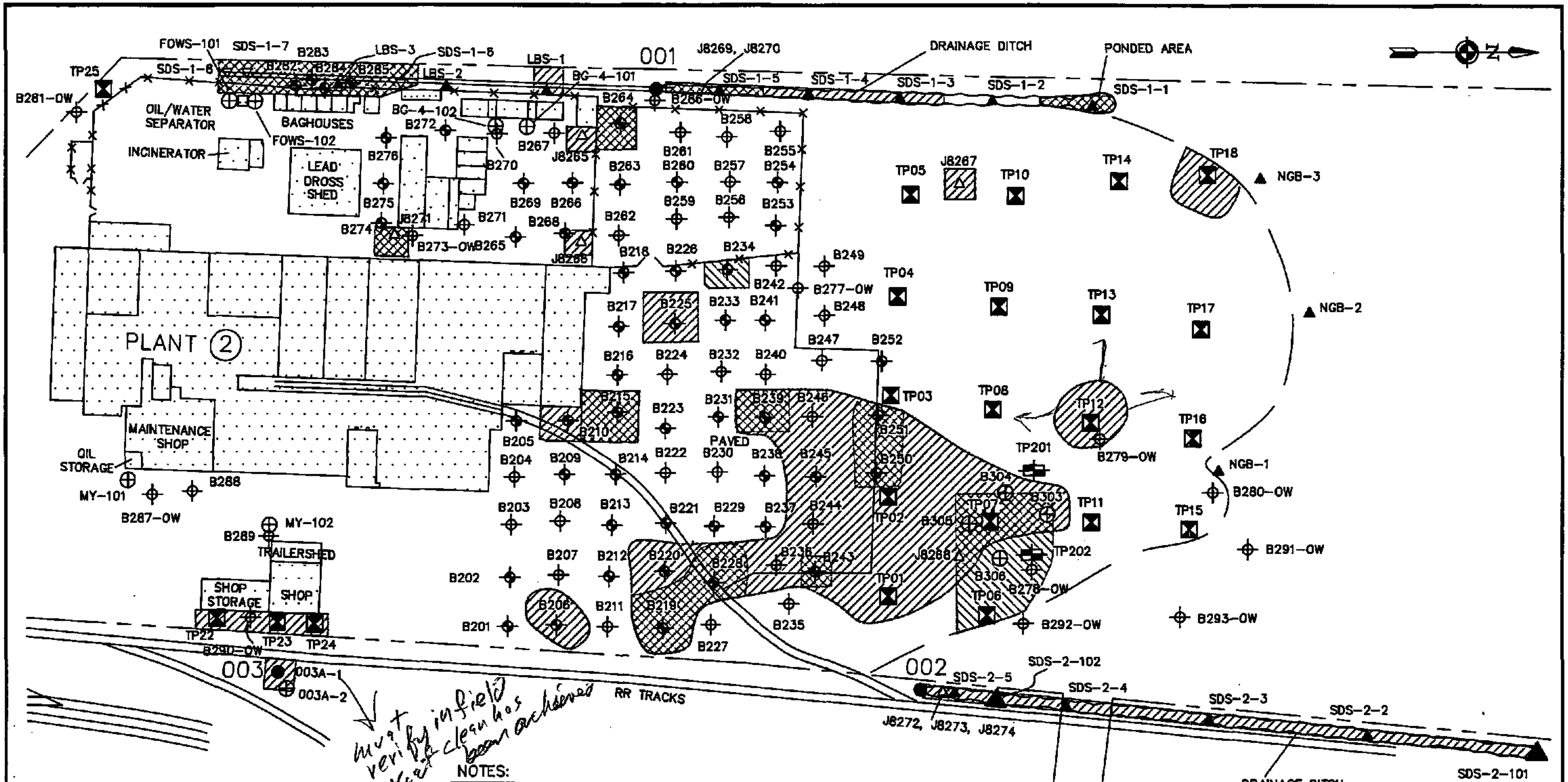
PROJECT LOCUS

SCALE: 1 IN. = 2000 FT.

FILE NO. 70185-43

CHARRETTE

FIGURE 1



must verify in field that clean has been achieved

must extend to clean!

NOTES:

AREA WITHIN HATCHURED MARKS INCLUDES SOIL WITH TOTAL LEAD CONCENTRATIONS > 825 PPM. AREA IS ESTIMATE ONLY BASED ON SAMPLING AND ANALYSIS PERFORMED TO DATE.

AREA WITHIN HATCHURED MARKS INCLUDES SOIL WITH TCLP LEAD CONCENTRATIONS > 5 PPM. AREA IS ESTIMATE ONLY BASED ON SAMPLING AND ANALYSIS PERFORMED TO DATE.

ACTUAL EXTENT OF COMPOUND PRESENCE MAY DIFFER.

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Geotechnical Engineers & Environmental Consultants

ROTH BROS. SMELTING CORPORATION
EAST SYRACUSE, NEW YORK

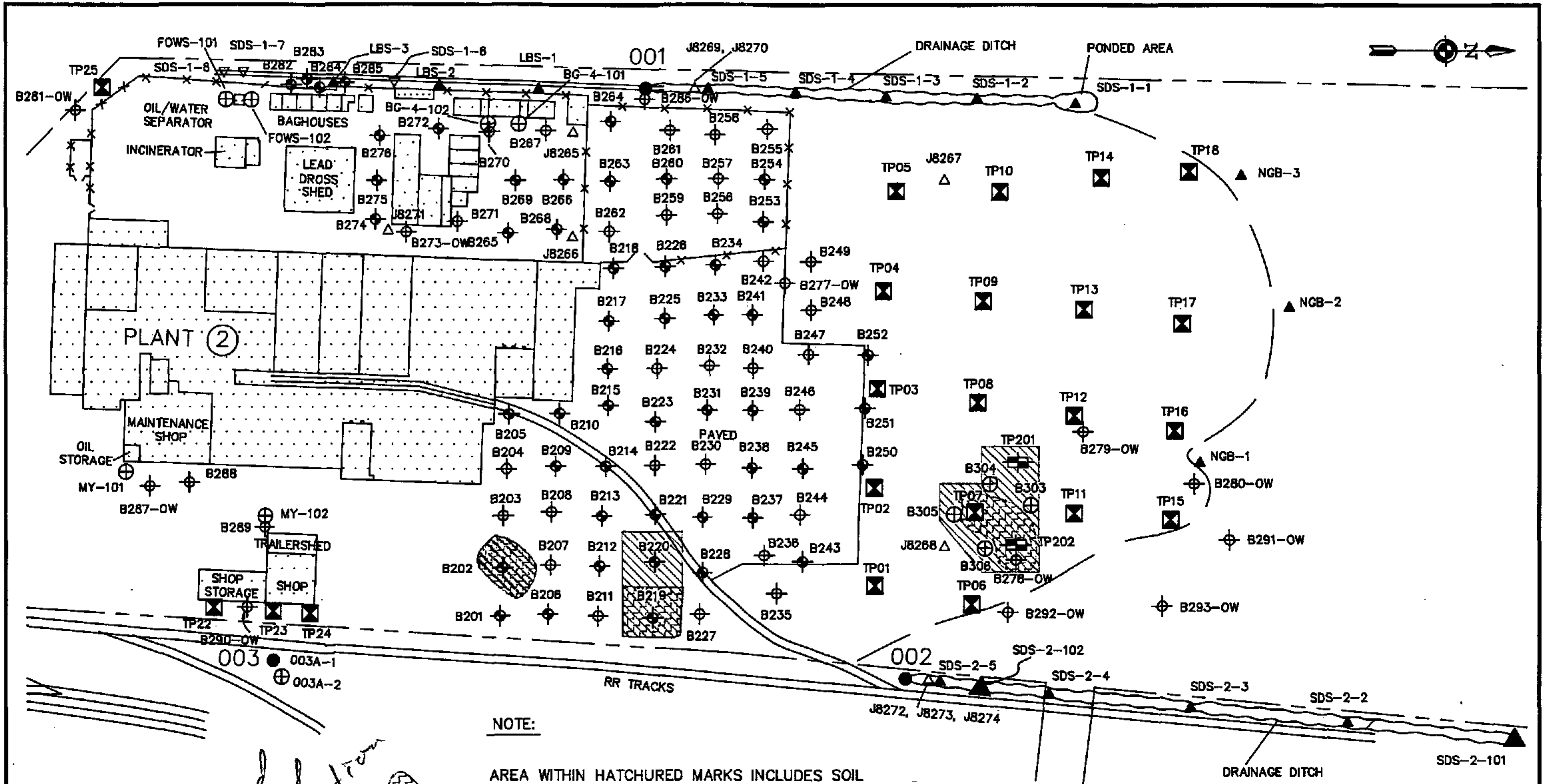
TARGETED TOTAL LEAD AND TCLP LEAD REMEDIATION AREAS

SCALE: 1 IN. = 100 FT.
JULY 1993

X:\ACAD\70185-43\FILL2.DWG

FIGURE 2

FILE NO. 70185-43



NOTE:

extend area of excavation

AREA WITHIN HATCHURED MARKS INCLUDES SOIL WITH PCB'S CONCENTRATIONS > 50 PPM. AREA IS ESTIMATE ONLY BASED ON SAMPLING AND ANALYSIS PERFORMED TO DATE.

AREA WITHIN HATCHURED MARKS INCLUDES SOIL WITH PCB'S CONCENTRATIONS > 25 PPM. AREA IS ESTIMATE ONLY BASED ON SAMPLING AND ANALYSIS PERFORMED TO DATE.

ACTUAL EXTENT OF COMPOUND PRESENCE MAY DIFFER.

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EAST SYRACUSE, NEW YORK

PCB EXCAVATION AREAS

SCALE: 1 IN. = 100 FT. JULY 1993

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FIGURE 3

FILE NO. 70185-43

Appendix A

Appendix A

APPENDIX A

Site Analytical Data
From Previous Investigations

TABLE III
ROTH BROS. SMELTING CORP.
PLANT 2

SUMMARY OF LABORATORY ANALYTICAL DATA

LOCATION	SAMPLE NO.	LEAD TOTAL	LEAD TCLP	CHROMIUM TOTAL	CHROMIUM TCLP	CADMIUM TOTAL	CADMIUM TCLP	GREASE AND OIL	PCBs 1242	PCBs 1248	PCBs 1254	PCBs 1260	PCBs TOTAL
FILL AREA	TP01-J1	10900	ND	121.0	ND	45.10	ND	1380	ND	8.90	ND	ND	8.90 D
	TP02-J1	25100	ND	23.4	ND	5.00	ND	300	ND	1.06	0.553	ND	1.613
	TP03-J1	16.9	ND	15.4	ND	2.00	ND	126	ND	ND	ND	ND	ND
	TP05-J1	157.0	ND	19.7	ND	2.10	ND	264	ND	0.128	ND	ND	0.128
	TP06-J1	216.0	14.30	13.2	ND	2.30	ND	396	ND	1.56	ND	ND	1.56
	TP07-J1	140.0	12.90	39.5	ND	5.30	ND	939	ND	204	ND	ND	204 D
	TP08-J1	390.0	1.290	78.8	ND	10.20	ND	758	ND	4.15	ND	ND	4.15 D
	TP09-J1	18.0	ND	17.7	ND	1.78	ND	416	ND	ND	ND	ND	ND
	TP10-J1	21.6	ND	16.9	ND	1.48	ND	496	ND	ND	ND	ND	ND
	TP11-J1	325	0.203	282.0	ND	5.24	ND	1453	ND	0.933	0.447	ND	1.380
	TP12-J1A	14300	ND	243.0	ND	53.80	ND	1600	7.87	ND	2.48	ND	10.35 D
	TP12-J1B*	10400	ND	224.0	ND	52.00	ND	137	8.87	ND	2.07	ND	10.94 D
	TP18-J1	2980	0.131	44.0	ND	10.80	ND	ND	0.089	ND	0.241	ND	0.330
	J8265	1600	1.100	55.0	ND	13.00	0.160	NA	NA	NA	NA	NA	ND
	J8266	1400	0.520	80.0	ND	13.00	0.120	NA	NA	NA	NA	NA	ND
	J8267	2800	1.600	91.0	ND	11.00	0.092	NA	NA	NA	NA	NA	ND
	J8268	5400	1.200	120.0	ND	11.00	0.024	NA	NA	NA	NA	NA	ND
OUTFALL 001	SDS-1-1A	3160	17.70	157.0	ND	30.60	0.160	1455	ND	ND	2.35	ND	2.35 D
	SDS-1-1B*	4540	36.20	150.0	ND	24.90	0.250	1480	ND	ND	ND	ND	ND JSt
	SDS-1-2	438	0.619	19.7	ND	5.19	ND	841	ND	ND	ND	ND	ND
	SDS-1-3	5250	3.620	22.8	ND	15.30	ND	1440	ND	0.333	0.773	ND	1.106
	SDS-1-4	3860	0.142	29.7	ND	22.60	ND	1530	0.548	ND	0.339	ND	0.887
	SDS-1-5	214	11.60	64.7	ND	68.60	0.630	8750	0.542	ND	0.435	ND	0.977
	J8269	7600	7.200	43.0	ND	40.00	0.420	NA	6.90	ND	1.60	ND	8.50
OUTFALL 002	SDS-2-1	384	ND	11.4	ND	7.90	ND	4460	ND	ND	ND	ND	ND CR
	SDS-2-2	2060	ND	22.8	ND	13.10	ND	42500	ND	ND	ND	ND	ND CR
	SDS-2-3	1460	0.158	13.9	ND	11.40	ND	28100	ND	ND	ND	ND	ND
	SDS-2-4	1980	0.474	19.9	ND	15.50	ND	93900	0.300	ND	ND	ND	0.300
	SDS-2-5	1530	ND	18.3	ND	8.93	ND	37300	1.33	ND	ND	ND	1.33
	J8272	7300	1.100	54.0	ND	34.00	0.032	NA	4.00	ND	ND	ND	4.00
	J8274	NA	NA	NA	NA	NA	NA	100000	NA	NA	NA	NA	ND
BAGHOUSE AREA	LBS-1A	4300	0.366	9.6	ND	2570.00	ND	510	ND	ND	ND	ND	ND
	LBS-1B*	4440	ND	13.4	ND	38.50	ND	880	ND	ND	ND	ND	ND
	LBS-2	384	ND	18.9	ND	5.70	ND	439	ND	0.947	ND	ND	0.947 D
	LBS-3	287	5.07	17.5	ND	6.70	ND	2230	ND	15.0	ND	ND	15.0 D
	J8271	220000	12.0	170.0	ND	260.00	0.300	NA	NA	NA	NA	NA	ND
MAINTENANCE AREA	TP-22	8460	ND	52.7	ND	30.10	ND	22600	ND	ND	6.98	ND	6.98 D
	TP-23	1160	ND	37.1	ND	14.60	ND	8160	ND	ND	0.934	ND	0.934 D
	TP-24A	3810	0.337	84.0	ND	58.80	ND	3075	ND	ND	1.83	ND	1.83 D
	TP-24B*	4690	ND	108.0	ND	63.20	ND	3940	ND	ND	1.71	ND	1.71 D
PLANT 2 - SW CORNER	TP-25	72.7	ND	13.4	ND	1.36	ND	186	ND	ND	ND	ND	ND
NATIVE SOIL	NGB-1	6.7	ND	12.6	ND	ND	ND	1605	ND	ND	ND	ND	ND
	NGB-2	14.5	ND	24.0	ND	ND	ND	137	ND	0.897	ND	ND	0.897
	NGB-3	ND	ND	21.9	ND	ND	ND	180	ND	ND	ND	ND	ND
BACKGROUND	SGB-1	7.7	ND	8.2	ND	1.30	ND	270	ND	ND	ND	ND	ND
FORMER SUBSTATION	TSS-1	411	0.332	35.5	0.119	5.70	0.230	28300	ND	ND	ND	0.583	0.583 JSt
COMPARISON CRITERIA (2)	-	500	5.00	400	5.00	-	1.0	-	-	-	-	-	25

NOTES:

1. Results presented in parts per million (ppm).
2. Outlined values represent concentrations which exceed comparison criteria. Comparison criteria consist of: 1) NYSDEC recommended cleanup goal; 2) EPA Health-based criteria; 3) EPA Regulatory Levels for Toxicity Characteristic Constituents; and 3) EPA 40 CFR Part 761 PCB Spill Cleanup policy, 1987.
3. ND indicates analyte not detected above laboratory detection limits.
4. TCLP: Toxicity Characteristic Leaching Procedure
5. * Indicates sample is a duplicate.
6. NA indicates analyte not tested for in that sample.
7. *Samples J8265-J8269, J8271, J8272 and J8274 were analyzed by others prior to this investigation.*
8. JSt = Surrogate recoveries outside of control limits, analysis repeated, same results obtained, interference suspected. Value is reported as an estimated value,due to failure of QA/QC requirements.
9. D = Surrogate standards diluted out due to high concentrations of PCBs detected in sample.
10. R = Sample re-analyzed outside of holding time.

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FILE NO. 70185-40

TABLE III
ROTH BROS. SMELTING CORP.
PLANT 2

SUMMARY OF LABORATORY ANALYTICAL DATA
SOIL/FILL SAMPLES

(page 1 of 2)

LOCATION	SAMPLE NO.	DEPTH IN FEET	LEAD TOTAL	LEAD TCLP	PCB 1232	PCB 1242	PCB 1248	PCB 1254	PCB 1260	PCB TOTAL	pH VALUE	TOC	CEC
PAVED FILL AREA	B201-S1A	0.9-2.9	105	0.372	ND	ND	16.4	ND	ND	16.4	6.2		
NORTH OF PLANT 2	B201-S1B	0.9-2.9	68.2	0.461	ND	ND	23.9	ND	ND	23.9	7.4		
	B202-S1	1.0-3.0	575	1.49	ND	ND	82.7	ND	ND	82.7	9.2		
	B205-S1	1.0-3.0	131	0.226	ND	ND	13.5	ND	ND	13.5	8.3		
	B206-S1	1.0-3.0	2240	ND	ND	ND	20.6	ND	ND	20.6	8.9		
	B209-S1	1.0-3.0	302	0.383	ND	ND	1.4	ND	ND	1.40	9.0		
	B210-S1A	1.5-3.5	557	2.36	ND	ND	ND	3.70	ND	3.70	6.8		
	B210-S1B	1.5-3.5	6940	2.48	ND	ND	ND	3.73	ND	3.73	8.9		
	B212-S1	1.0-3.0	5.90	ND	ND	ND	0.025	ND	ND	0.025	9.5		
	B213-S1	1.0-3.0	35.3	ND	ND	ND	0.026	0.148	ND	0.172	8.7		
	B214-S1	1.0-3.0	231	ND	ND	ND	0.071	0.131	ND	0.202	8.9		
	B215-S1	1.0-3.0	6220	7.88	ND	0.550	ND	0.760	ND	1.31	8.7	1.47	4.14
	B216-S1	1.0-3.0	366	2.92	4.23	ND	ND	1.44	ND	5.67	8.4		
	B217-S1	1.0-3.0	33.4	ND	ND	ND	ND	0.238	ND	0.238	9.4	2.38	18.1
	B218-S1	1.0-3.0	124	4.54	ND	ND	1.89	1.53	ND	3.42	8.35		
	B219-S1	1.0-3.0	2370	7.52	ND	ND	ND	60.3	ND	60.3	9.0		
	B220-S1	1.0-3.0	3740	0.790	ND	ND	15.2	16	ND	31.2	9.3		
	B221-S1	1.0-3.0	98.9	ND	ND	ND	ND	ND	ND	0	8.9		
	B223-S1	1.0-3.0	56.7	ND	ND	ND	16.5	ND	ND	16.5	8.9		
	B225-S1	1.0-3.0	9730	ND	3.64	ND	ND	2.37	ND	6.01	9.0		
	B226-S1	1.0-3.0	314	2.11	ND	ND	0.738	1.10	ND	1.84	8.7		
	B228-S1	1.5-2.5	10300	29.2	ND	ND	0.362	0.671	ND	1.03	9.5	1.43	12.3
	B229-S1	1.0-3.0	156	0.730	ND	ND	7.35	1.05	ND	8.40	10.1		
	B231-S1	1.0-3.0	29.9	0.195	ND	ND	0.580	0.070	ND	0.650	10.0		
	B233-S1	1.0-3.0	250	1.13	2.38	ND	ND	1.81	ND	4.19	8.7		
	B234-S1	1.0-3.0	64.3	11.0	0.236	ND	ND	0.030	ND	0.266	7.9		
	B237-S1	1.0-3.0	196	ND	ND	ND	0.512	0.648	ND	1.16	7.15		
	B238-S1	1.0-3.0	160	ND	ND	ND	1.28	0.399	ND	1.68	6.9		
	B239-S1	1.0-3.0	31.4	ND	ND	ND	ND	0.027	ND	0.027	6.4		
	B239-S2	3.0-5.0	1280	21.6	ND	ND	0.894	0.761	ND	1.66	7.2		
	B241-S1	0.5-2.5	ND	0.160	ND	ND	ND	ND	ND	0.0	8.75		
	B243-S1	1.0-3.0	40000	ND	ND	ND	0.904	ND	ND	0.904	6.55		
	B243-S2	3.0-5.0	56500	30.7	ND	ND	4.97	ND	ND	4.97	11.5		
	B245-S1	1.0-3.0	14700	ND	ND	ND	1.05	ND	ND	1.05	10.4		
	B250-S1	0.0-2.0	15000	28.0	ND	ND	1.32	3.82	ND	5.14	9.55		
	B251-S1	0.0-2.0	3570	28.0	ND	ND	6.00	3.63	ND	9.63	9.2		
	B252-S1	0.0-2.0	147	ND	ND	ND	19.3	ND	ND	19.3	11.5		
COMPARISON CRITERIA (2)			500	5.00						25			

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ROCHESTER, NEW YORK

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TABLE III
ROTH BROS. SMELTING CORP.
PLANT 2

SUMMARY OF LABORATORY ANALYTICAL DATA
SOIL/FILL SAMPLES

LOCATION	SAMPLE NO.	DEPTH IN FEET	LEAD TOTAL	LEAD TCLP	PCB 1232	PCB 1242	PCB 1248	PCB 1254	PCB 1260	PCB TOTAL	pH VALUE	TOC	CEC
BAGHOUSE/SCRAP	B253-S1	1.0-3.0	34.8	ND	ND	ND	ND	ND	ND	0.0	10.4		
STORAGE AREA	B254-S1	1.0-3.0	16.0	ND	ND	ND	ND	ND	ND	0.0	10.1		
	B254-S2	3.0-5.0	ND	ND	ND	ND	ND	ND	ND	0.0	8.5		
	B260-S1A	1.0-3.0	44.6	ND	ND	ND	ND	0.980	ND	0.0	7.0		
	B260-S1B	1.0-3.0	33.0	ND	ND	ND	ND	0.076	ND	.980	6.8		
	B263-S1A	1.0-3.0	17.7	ND	ND	ND	0.021	0.285	ND	.076	8.7		
	B263-S1B	1.0-3.0	63.2	ND	ND	ND	ND	ND	ND	.306	8.8		
	B263-S2	3.0-5.0	ND	ND	ND	ND	0.711	0.691	ND	0.0	8.3		
	B264-S1	0.5-2.5	29600	189	ND	ND	0.330	0.593	ND	1.402	7.6		10.2
	B265-S1	0.5-2.5	ND	ND	ND	ND	ND	0.133	ND	.973	8.2		
	B266-S1	0.5-2.5	30.0	ND	ND	ND	ND	0.031	ND	.133	8.9		6.96
	B268-S1	0.5-2.5	64.0	ND	ND	ND	ND	4.95	ND	.031	8.65		
	B269-S1	0.5-2.5	ND	ND	ND	ND	ND	ND	ND	4.95	8.9		
	B272-S1	1.0-3.0	38.3	ND	ND	ND	ND	0.267	ND	0.0	8.6		
	B273-S1	1.0-3.0	33.0	ND	ND	ND	ND	0.552	ND	.267	7.05		
	B274-S1	1.0-3.0	2980	ND	ND	ND	ND	0.517	ND	.552	10.15		
	B275-S1	1.0-3.0	152	ND	ND	ND	ND	0.060	ND	.517	9.6		
	B276-S1	1.0-3.0	350	ND	ND	ND	ND	ND	ND	.060	8.4		
FILL AREA	B278-S1	0-2.0	752	5.05	ND	ND	72.3	ND	ND	72.3	7.8		8.79
	B278-S2	2.0-4.0	120	ND	ND	ND	27.7	ND	ND	27.7	8.55		
	B278-S3	4.0-6.0	ND	ND	ND	ND	0.067	ND	ND	.067	7.2		
	TP201-J1	1.5-2.5	563	4.35	ND	ND	29.4	ND	ND	29.4	10.35	1.40	4.28
	TP201-J2	2.5-3.0	42.0	ND	ND	ND	1.62	ND	ND	1.62	10.2	ND	3.83
	TP202-J1	2.5-3.0	348	5.40	ND	ND	164	ND	ND	164	8.9		
LBS-3 AREA	B282-S1	0-2.0	1850	12.2	ND	ND	7.13	ND	ND	7.13	8.15	1.37	6.00
	B283-S1	0-2.0	2650	22.7	ND	ND	3.19	ND	ND	3.19	8.2		
	B284-S1	0-2.0	1530	14.3	ND	ND	40.1	ND	ND	40.1	8.75	1.04	6.08
	B285-S1	0-4.0	3740	21.0	ND	ND	0.447	0.803	ND	1.25	7.95		
STORM SEWER	SDS-1-6	0-0.3	26500	157	ND	ND	9.20	ND	1.72	10.92	8.9	2.15	
DISCHARGE	SDS-1-7	0-0.3	35700	74.5	ND	ND	10.3	ND	1.65	11.95	8.7	7.23	
	SDS-1-8	0-0.3	41500	135	ND	ND	1.78	ND	2.80	4.58	7.55	11.5	
COMPARISON CRITERIA (2)			500	5.00						25			

NOTES:

1. Concentrations expressed in parts per million (ppm). See also note 7.
2. Concentrations which are outlined exceed comparison criteria.
   Comparison criteria consist of: 1) Superfund Record of Decision: United Scrap Lead, OH (Sept. 1988): 1987) 2) EPA Regulatory Levels for Toxicity Characteristics Constituents; and 3) EPA 40 CFR Part 761 PCB Spill Cleanup Policy 1987.
3. ND indicates analyte not detected above laboratory detection limits.
4. TCLP: Toxicity Characteristic Leaching Procedure
5. TOC: Total Organic Carbon. Analyses performed on subset of 10 samples.
6. PCB Total: Sum total of PCBs detected.
7. CEC: Cation Exchange Capacity. Analyses only performed on subset of 10 samples. Concentrations expressed in milliequivalents per 100 grams (meq/100 g).

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TABLE III
SUMMARY OF LABORATORY ANALYSES - SOIL
REMAINING RFI ACTIVITIES
ROTH BROS. SMELTING CORP.
(Page 1 of 2)

SAMPLE LOCATION	SAMPLE NUMBER	TOTAL LEAD (ppm)	TCLP LEAD (ppm)	PCB 1248	PCB 1254	PCB 1260	TOTAL PCBs (ppm)	TOTAL SEMI-VOLATILES* (ppm)	TOTAL PETROLEUM HYDROCARBONS (ppm)	OIL & GREASE (ppm)	TOTAL ORGANIC CARBON (%)
Chickery	SS-101							9.0			
Garage	SS-102							31.07			
Copper Wire Incinerator Shed	SS-107			ND	ND	ND	ND				
Former Substation (SWMU No. 44)	*SS-106*							ND	ND		
Outfall 001 (SWMU No. 45)	SDS-1-101 SDS-1-102 006 (SDS-1-102 Dup.)	5030 7000 8720	105 74.6 199	ND 2.400 ND	7.500 1.700 ND	ND ND ND	7.50 4.100 ND	17.77 12.00			0.714 1.10
Outfall 002 (SWMU No. 46)	SDS-2-101 SDS-2-102	379 7350	1.27 1.59	0.057 4.100	ND ND	ND ND	0.057 4.100	ND ND			1.91 14.1
Aluminum Turnings Yard (SWMU Nos. 7 and 8)	AL-101 AL-102 AL-103 *AL-104*							ND ND ND *ND(AL-102 Dup.)*		ND ND 883 *ND(AL-103 Dup.)*	
Loading Station/Secondary Containment (SWMU Nos. 9 and 10	LSSC-101							ND			
Maintenance Yard (SWMU No. 32 and 33, AOC A)	MY-101 MY-102	62.0 178.0	0.157 0.240	0.540 22.000	ND ND	ND ND	0.540 22.000	ND ND			
Former Oil Water Separator	FOWS-101 FOWS-102	ND 70.1	0.168 0.202	ND ND	ND ND	ND ND	ND ND				
Outfall 003 (SWMU No. 39)	003-1 (0'-.1') 003-2 (3'-5')	4200 ND	0.253 0.150	ND ND	ND ND	ND ND	ND ND				
Outfall 004 (SWMU No. 39)	*004-1 (0'-.1')* 004-2 (3'-5')	270 ND	0.229 0.145	8.200 ND	ND ND	ND ND	8.200 ND	 ND			
Outfall 005 (SWMU No. 39)	005-A (3'-5') 005-B (2.5'-5')	ND	0.191	0.480 ND	ND ND	ND ND	0.480 ND	 1.46			

FILE NO. 70185-43

H & A OF NEW YORK
ROCHESTER, NEW YORK

TABLE III
SUMMARY OF LABORATORY ANALYSES-SOIL
REMAINING RFI ACTIVITIES
ROTH BROS. SMELTING CORP.
(Page 2 of 2)

SAMPLE LOCATION	SAMPLE NUMBER	TOTAL LEAD (ppm)	TCLP LEAD (ppm)	PCB 1248	PCB 1254	PCB 1260	TOTAL PCBs (ppm)	TOTAL SEMI-VOLATILES* (ppm)	TOTAL PETROLEUM HYDROCARBONS (ppm)	OIL & GREASE (ppm)	TOTAL ORGANIC CARBON (%)
Baghouse No. 4 (SWMU No. 22)	BG-101:S1	14.8	0.145	ND	1.500	ND	1.500	ND			
	BG-101:S2	ND	0.158	ND	ND	0.032	0.032	ND			
	BG-102:S1	190	0.162	ND	3.00	ND	3.00	ND			
	BG-102:S2	ND	0.119	ND	ND	ND	ND	ND			
Suspected Oil Seep (SWMU No. 43)	SOS-1								ND		
	SOS-2 (SOS-1 Dup.)								ND		
Fill Area (SWMU No. 29)	B303-S1	4870	0.948								
	B303-S2	300	0.654								
	B303-S4	315	1.11								
	B303-S5	ND	ND								
	B304-S1	3500	1.05								
	B304-S2	745	1.23								
	B304-S3	ND	ND								
	B304-S4	18.0	ND								
	B304-S5	ND	ND								
	B305-S1	3010	0.204								
	B305-S2	3210	0.208								
	B305-S3	165	ND								
	B305-S4	ND	ND								
	B305-S5	ND	0.148								
	B306-S1	449	0.998								
	B306-S2	25.8	0.132								
	B306-S4	ND	0.118								
	B306-S5	ND	0.123								
	B308-S3 (B305-S3 Dup.)	208	0.131								
Background	SS-103	183	0.225								
	SS-104	172	0.203								

Notes:

vhd:gmc\70185-43\tsoilsam.wp

1. * See Table IV for summary of specific semi-volatile organic compounds detected in soil and sediment samples.
2. ND = Not detected above laboratory detection limits.
3. See Appendix D for laboratory analytical results.

Appendix B

Appendix B

APPENDIX B

Software Printout from
Vendor Information System for Innovative
Treatment Technologies (VISITT)

Double check all data and use ATTIC

06/11/93

UNITED STATES ENVIROMENTAL PROTECTION AGENCY
VENDOR INFORMATION SYSTEM FOR INNOVATIVE TREATMENT TECHNOLOGIES (VISITT)

Part 1: General Information and Technology Overview

Date submitted: 01/29/92

Developer/Vendor name: NORTHWEST ENVIROSERVICE, INC.

Street address: P.O. Box 24443, 1700 Airport Way South

City: Seattle State: WA Zip: 98124

Country: USA

Contact name: Richard Owings, Tory Larsen, Steve Simmo
and title...: Project Manager, VP Field Serv, VP Alask

Contact phone: (206) 622-1085 Fax Number: (206) 622-6344

Telex number: ( ) -

Standard technology type:
SOIL WASHING

Technology name assigned by vendor (e.g., trade name):

Technology is being or has been tested in EPA SITE Program ? Yes

Literature on technology available on request ? Yes

Part 1: General Information and Technology Overview (continued)

Vendor name....: NORTHWEST ENVIROSERVICE, INC.

Technology type: SOIL WASHING

General description of technology:

Soil washing employs simple physical and chemical processes to remove contaminants from soil or sludge. The process uses well known minerals handling technology to separate the contaminated material into two or more fractions. The fractions are cleaned using physical (e.g. scrubbing, heat, pressure jets) and chemical steps (e.g. pH adjustment, oxidation). The washing fluid may be composed of water or water with chelating or surfactants, acids or bases, depending on the contaminant to be cleaned. The equipment is mobile and operates continuously. The process works best on particles greater than 270 mesh, however, smaller particles can be treated in a combination of soil washing with bioremediation, thermal and/or chemical extraction. Soil washing reduces remediation costs by reducing the volume of material that requires RCRA disposal and/or ancillary treatment.

Part 1: General Information and Technology Overview (continued)

Vendor name....: NORTHWEST ENVIROSERVICE, INC.

Technology type: SOIL WASHING

Technology highlights:

The advantages of soil washing are:

* Potential for removal of a wide range of organic and inorganic wastes. It is particularly suited for TPH reduction.

* Equipment used is well known, readily available, mobile and easily operated.

* Field monitoring can provide immediate determination of contaminant reduction as well as consistent treatment of the contaminated materials.

* The technology can significantly reduce (e.g. 80% to 90%) the volume of materials that require transportation and/or treatment with ancillary methods (e.g. thermal, bioremediation, extraction, etc.).

Part 1: General Information and Technology Overview (continued)

Vendor name....: NORTHWEST ENVIROSERVICE, INC.

Technology type: SOIL WASHING

Technology status:

_ Bench scale or emerging. Technology shown to be feasible through the use of bench-top equipment in the laboratory. Available data cannot be used to scale up to full scale in the absence of additional pilot-scale or full-scale experience for similar applications.

_ Pilot scale. Available equipment is of sufficient size to verify technology feasibility or establish the design and operating conditions for a full-scale system. However, it is not of the size typically used for a cleanup.

X Full scale. Available equipment is sized and commercially available for actual site remediation.

Potential or actual waste/media treated:

X Soil

X Sludge

X Solid

X Natural sediment

_ Ground water in situ

Part 1: General Information and Technology Overview (continued)

Vendor name....: NORTHWEST ENVIROSERVICE, INC.

Technology type: SOIL WASHING

Potential or actual contaminants and contaminant groups treated by this technology:

Organic

X Halogenated volatiles

X Halogenated semivolatiles

X Nonhalogenated volatiles

X Nonhalogenated semivolatiles

_ Organic pesticides/herbicides

X Dioxins/furans

X PCBs

X Polynuclear aromatics (PNAs)

X Solvents

X Benzene-toluene-ethylbenzene-xylene (BTEX)

_ Organic cyanide

_ Organic corrosives

Inorganic

X Heavy metals

_ Nonmetallic toxic elements

_ Radioactive metals

_ Asbestos

_ Inorganic cyanides

_ Inorganic corrosives

Miscellaneous

_ Explosives/propellents

_ Organometallic pesticides/herbicides

Others:

FOIL206674

Part 1: General Information and Technology Overview (continued)

Vendor name....: NORTHWEST ENVIROSERVICE, INC.

Technology type: SOIL WASHING

General sources or types of industrial waste or contaminated sites that the technology can address:

X	Agriculture	X	Paint/ink formulation
X	Battery recycling/disposal	_	Pesticide manufacturing/use
_	Chloro-alkali manufacturing	X	Petroleum refining and reuse
X	Coal gasification	_	Photographic products
X	Dry cleaners	X	Plastics manufacturing
_	Electroplating	_	Pulp and paper industry
_	Herbicide manufacturing/use	_	Other organic chemical manufacturing
_	Industrial landfills	_	Other inorganic chemical manufacturing
_	Inorganic/organic pigments	_	Semiconductor manufacturing
X	Machine shops	X	Rubber manufacturing
X	Metal ore mining and smelting	X	Wood preserving
_	Municipal Landfill	X	Uranium mining
X	Munitions Manufacturing		

Others:

Part 1: General Information and Technology Overview (continued)

Vendor name....: NORTHWEST ENVIROSERVICE, INC.

Technology type: SOIL WASHING

Technology limitations:

Efficient cleaning of the finer or clay fractions (<270 mesh) has required a combination of soil washing with other technology like bioremediation or simply disposal of the fine fraction.

Complex waste mixtures (e.g. metals with organics) make washing fluid formulation difficult.

Technology status comments:

We have pilot, treatability and production level equipment on hand. We have conducted research and development work on soil washing for TPH and metal removal over the last five year period.

The technology is well known and in common use in Europe, particularly in the Netherlands and Germany.

PART 2: Pilot- and Full-scale Technologies:
Detailed Information and Performance Data

Vendor name....: NORTHWEST ENVIROSERVICE, INC.

Technology type: SOIL WASHING

Vendor services:

_ Equipment manufacture

X Subcontractor for cleanup services

X Prime contractor for full-service remediation

Pilot-scale Equipment/Capabilities

Major unit processes:

Major components are:

* Trommel screens
* attrition tanks
* weir/skimmer and settlement tank
* water heating and recirculation equipment
* laboratory test/monitoring equipment

PART 2: Pilot- and Full-scale Technologies:
Detailed Information and Performance Data (continued)

Vendor name....: NORTHWEST ENVIROSERVICE, INC.

Technology type: SOIL WASHING

Number of pilot-scale systems:

_____ Planned/in design

_____ Under construction

1 Constructed

Pilot-scale facility is:

X Transportable

_ Fixed

_ In situ

Pilot capacity range per hour. Capacity of batch processes is prorated.

200.00 to 2000.00 Pounds

Can you conduct pilot-scale treatability studies on some type of waste at your location? Yes

At a contaminated site? Yes

Quantity of waste needed for pilot-scale treatability study:

5 to 15 Cubic yard

Number of pilot-scale studies conducted on wastes from different sources or sites. Does not include tests on surrogate wastes.

5

PART 2: Pilot- and Full-scale Technologies:
Detailed Information and Performance Data (continued)

Vendor name....: NORTHWEST ENVIROSERVICE, INC.

Technology type: SOIL WASHING

Full-scale Equipment/Capabilities

Major unit processes:

Major components are:

* Soil feeding and coarse screening/metering (e.g. vibrating screen and sand screws)
* Soil mixing/washing (e.g. trommel and tank)
* Process water treatment and recirculation (attrition tanks/settlement tanks, weir and skimmer)
* Pumping system and boiler
* Centrifuge/belt filter (optional) if dewatering is needed
* Exhaust air treatment if needed (e.g. cyclone, scrubber etc.)
* Laboratory analysis equipment
* (see attached schematic)

PART 2: Pilot- and Full-scale Technologies:
Detailed Information and Performance Data (continued)

Vendor name....: NORTHWEST ENVIROSERVICE, INC.

Technology type: SOIL WASHING

Full-scale facility is:

X Transportable _ Fixed _ In situ

Full capacity range per hour:

20.00 to 25.00 Tons

Logistical requirements for transportable or in situ technologies:

Space (area)....: 2000 ft2

Water ....: 500 gals. per day

Electrical power: 100 amps

460 volts

Natural gas.....: ____ ft3 per day

Sewage access...: _ yes X no

"Ballpark" estimate of price range per unit of waste treated:

50.00 to 150.00 per Ton

Price estimates shown above do not always include all indirect costs associated with treatment, such as: excavation, permits and treatment of residuals. For price comparisons, users should make certain that vendors provide estimates based on comparable remediation activities.

PART 2: Pilot- and Full-scale Technologies:
Detailed Information and Performance Data (continued)

Vendor name....: NORTHWEST ENVIROSERVICE, INC.

Technology type: SOIL WASHING

Number of full-scale cleanups initiated or completed by this firm using this technology:

2

For equipment manufacturers - estimated or actual number of full-scal cleanups by other firms using this equipment:

______

Major permits obtained for a full-scale system, and issuing authority (e.g., RCRA, TSCA, NPDES, and Clean Air Act).

Permit Type.......: mobile equipment
Issuing Authority.:

Permit Type.......: TSD
Issuing Authority.:

Permit Type.......: Hazardous Waste transport
Issuing Authority.:

Permit Type.......: Fire
Issuing Authority.:

Number of full-scale systems:

______ Planned/in design

______ Under construction

3 Constructed

PART 2: Pilot- and Full-scale Technologies:
Detailed Information and Performance Data (continued)

Vendor name....: NORTHWEST ENVIROSERVICE, INC.

Technology type: SOIL WASHING

Treatability Study Capabilities (Bench Scale)

Can you conduct bench-scale treatability studies on some types of waste at your location: X yes _ no

Number of bench-scale studies conducted to date. Does not include tests on surrogate wastes:

5

Description of bench-scale testing procedures:

Bench-scale soil washing is done by using an electric mixer and blade such as those used to mix bread dough or batter. The mixture is homogenized with cold and/or hot water with adjustments in pH, surfacants, or detergents. Wash water and solids are settled in graduated cylinders by gravity. Laboratory analysis is completed on wash water and remaining soilds.

SUMMARY OF PERFORMANCE DATA

Vendor name....: NORTHWEST ENVIROSERVICE, INC.

Technology type: SOIL WASHING

Contaminant, contaminant group, or pollutant parameter:

Petroleum Hydrocarbons - Total

Untreated concentration range Mg/kg	Treated concentration range Mg/kg	Equipment Scale
11000.000 to 15000.000	23.000 to 530.000	Pilot scale

Waste description:

oil in soil

Soil classification:

fine soil or sand

Comments:

oil spill on beach

SUMMARY OF PERFORMANCE DATA

Vendor name....: NORTHWEST ENVIROSERVICE, INC.

Technology type: SOIL WASHING

Contaminant, contaminant group, or pollutant parameter:

Arsenic

Untreated concentration range Mg/kg	Treated concentration range Mg/kg	Equipment Scale
3000.000 to 9500.000	350.000 to 2100.000	Pilot scale

Waste description:

arsenic in soil

Soil classification:

clay and fine sand

Comments:

alkaline washing process for arsenic in soil

SUMMARY OF PERFORMANCE DATA

Vendor name....: NORTHWEST ENVIROSERVICE, INC.

Technology type: SOIL WASHING

Contaminant, contaminant group, or pollutant parameter:

Lead

Untreated concentration range Mg/kg	Treated concentration range Mg/kg	Equipment Scale
1034.000 to 1300.000	23.000 to 351.000	Pilot scale

Waste description:

lead in soil

Soil classification:

fine sand

Comments:

chemical washing study

REPRESENTATIVE CLEANUP PROJECTS

Vendor name : NORTHWEST ENVIROSERVICE, INC.

Technology type: SOIL WASHING

Site name : Prince William Sound *

City : State: AK

Country : USA

Project type : SUPERFUND

Client contact : Jim Hayden

Affiliation : Alaska Dpt of Environmental Conservation

Phone number : (907) 465-2110

Equipment Scale:

_ Bench scale

_ Pilot scale

X Full scale

Project status (Month/Year):

Contracted : 2/89

Underway : ____

Completed/To be completed : ____

Waste description:

Exxon Valdez spill producing oily water, sludge and contaminated sand

REPRESENTATIVE CLEANUP PROJECTS

Vendor name : NORTHWEST ENVIROSERVICE, INC.

Technology type: SOIL WASHING

Site name : Queen City Farms *

City : Issaquah State: WA

Country : USA

Project type : SUPERFUND/PRIVATE LEAD

Client contact : Dick Burris

Affiliation : The Boeing Co.

Phone number : (206) 395-0322

Equipment Scale:

_ Bench scale

_ Pilot scale

X Full scale

Project status (Month/Year):

Contracted : ____

Underway : X

Completed/To be completed : ____

Waste description:

Chemical sludge pond

06/11/93

REPRESENTATIVE CLEANUP PROJECTS

Vendor name : NORTHWEST ENVIROSERVICE, INC.

Technology type: SOIL WASHING

Site name : Schuster Parkway

City : Tacoma State: WA

Country : USA

Project type : STATE

Client contact : Don Ferguson

Affiliation : WA State Dept of Transportation

Phone number : (206) 627-5030

Equipment Scale:

_ Bench scale

_ Pilot scale

X Full scale

Project status (Month/Year):

Contracted : ____

Underway : ____

Completed/To be completed : 9/86

Waste description:

Oil and polyaromatic hydrocarbons in soil spill

UNITED STATES ENVIROMENTAL PROTECTION AGENCY
VENDOR INFORMATION SYSTEM FOR INNOVATIVE TREATMENT TECHNOLOGIES (VISITT)

Part 1: General Information and Technology Overview

Date submitted: 12/02/91

Developer/Vendor name: ELECTROKINETICS, INC.

Street address: Louisiana Business and Technology Center, LSU
South Stadium Drive

City: Baton Rouge State: LA Zip: 70803-6100

Country: USA

Contact name: Yalcin B. Acar/Robert J. Gale
and title...: President/Vice President

Contact phone: (504) 388-3992 Fax Number: (504) 388-3975

Telex number: ( ) -

Standard technology type:
ELECTRICAL SEPARATION

Technology name assigned by vendor (e.g., trade name):

Technology is being or has been tested in EPA SITE Program ? Yes

Literature on technology available on request ? Yes

Part 1: General Information and Technology Overview (continued)

Vendor name....: ELECTROKINETICS, INC.

Technology type: ELECTRICAL SEPARATION

General description of technology:

Electrokinetic soil processing is an "in situ" semi-continuous process for the removal of heavy metals, radionuclides, and organic bases from fine-grained silty clays. The application of a low intensity direct current (DC) applied across the contaminated soil, results in removal of the contaminants through mass transfer mechanisms of advection, diffusion, and ion migration.

The full-scale electrokinetic soil process is considered "in situ" semi-continuous as the pollutants present in the fine-grained soils are removed in cycles. One cycle will typically capture 75-95 mass percent of original contaminant and require 2-3 months. Each cycle involves application of DC current, removal of the contaminants at the cathodes in either soluble or precipitated forms, and replacement of the subsurface fluids to original field capacity. Additional cycles may be used to meet low client final specifications.

Unique features of electrokinetic soil processing include rapid desorption and removal of contaminants tightly bound in silty clay matrices, when compared to other processes which require extensive treatment of groundwater when removal rate is dependent on sorption equilibria. Electrokinetic soil processing can be used for concentration of specific contaminants for recovery and re-use. Soluble uranium in clays, for example, can be concentrated and recovered as precipitate at the cathode regions and removed as "yellow cake".

Part 1: General Information and Technology Overview (continued)

Vendor name....: ELECTROKINETICS, INC.

Technology type: ELECTRICAL SEPARATION

Technology highlights:

Marketable features of electrokinetic soil processing include:

1. Removal of heavy metals, radionuclides, and organic bases from tight clays.

2. An "in situ" process where the soil remains in an undisturbed condition except for the shallow 3-4 inch diameter holes required for electrode placement.

3. Defusing of localized hot spots by conversion of these hot spots into plumes which are transported by the acid front and the plumes are removed at the cathodes.

4. Electrokinetic soil processing is estimated to cost about one tenth of that for thermal destruction, and the contaminants will be concentrated into small volumes and recovered at the cathodes.

5. The full scale process is much safer than processes which either mix the contaminants at the site or move contaminants off the site as there will be no appreciable hazardous pollutant vectors either above or below the soil surface.

6. An initial bench scale treatability study is used to define electrokinetic process parameters and provide assurance for actual site remediation.

Part 1: General Information and Technology Overview (continued)

Vendor name....: ELECTROKINETICS, INC.

Technology type: ELECTRICAL SEPARATION

Technology status:

_ Bench scale or emerging. Technology shown to be feasible through the use of bench-top equipment in the laboratory. Available data cannot be used to scale up to full scale in the absence of additional pilot-scale or full-scale experience for similar applications.

X Pilot scale. Available equipment is of sufficient size to verify technology feasibility or establish the design and operating conditions for a full-scale system. However, it is not of the size typically used for a cleanup.

Can we automatically exclude any non-full scale process?

_ Full scale. Available equipment is sized and commercially available for actual site remediation.

Potential or actual waste/media treated:

X Soil

X Sludge

_ Solid

X Natural sediment

_ Ground water in situ

Part 1: General Information and Technology Overview (continued)

Vendor name....: ELECTROKINETICS, INC.

Technology type: ELECTRICAL SEPARATION

Potential or actual contaminants and contaminant groups treated by this technology:

Organic

- X Halogenated volatiles
- _ Halogenated semivolatiles
- X Nonhalogenated volatiles
- _ Nonhalogenated semivolatiles
- _ Organic pesticides/herbicides
- _ Dioxins/furans
- _ PCBs
- _ Polynuclear aromatics (PNAs)
- _ Solvents
- X Benzene-toluene-ethylbenzene-xylene (BTEX)
- _ Organic cyanide
- _ Organic corrosives

Inorganic

- X Heavy metals
- _ Nonmetallic toxic elements
- X Radioactive metals
- _ Asbestos
- _ Inorganic cyanides
- _ Inorganic corrosives

Miscellaneous

- _ Explosives/propellents
- _ Organometallic pesticides/herbicides

Others:

FOIL206695

Part 1: General Information and Technology Overview (continued)

Vendor name....: ELECTROKINETICS, INC.

Technology type: ELECTRICAL SEPARATION

General sources or types of industrial waste or contaminated sites that the technology can address:

_	Agriculture	_	Paint/ink formulation
X	Battery recycling/disposal	_	Pesticide manufacturing/use
_	Chloro-alkali manufacturing	_	Petroleum refining and reuse
_	Coal gasification	_	Photographic products
_	Dry cleaners	_	Plastics manufacturing
X	Electroplating	_	Pulp and paper industry
_	Herbicide manufacturing/use	_	Other organic chemical manufacturing
_	Industrial landfills	X	Other inorganic chemical manufacturing
X	Inorganic/organic pigments	_	Semiconductor manufacturing
_	Machine shops	_	Rubber manufacturing
X	Metal ore mining and smelting	_	Wood preserving
_	Municipal Landfill	X	Uranium mining
X	Munitions Manufacturing		

Others:

FOIL206697

Part 1: General Information and Technology Overview (continued)

Vendor name....: ELECTROKINETICS, INC.

Technology type: ELECTRICAL SEPARATION

Technology limitations:

Technology would be less cost-effective in sands and gravels for organic compounds as these materials are more easily removed by vacuum and other sand washing techniques.

Complex mixtures of metals, and organic pollutants as found in some industrial and hazardous waste sites can obscure the electrochemistry and result in loss of removal efficiency.

Three dimensional removals of compounds from depths below 10 feet have not been explored by Electrokinetics Inc. at this time although there are reports from the Netherlands of removal of contaminants at depths up to 30 feet.

Technology status comments:

Research and development has been ongoing since 1986 with laboratory bench scale equipment and high removal efficiencies have been demonstrated with the following metals adsorbed on Georgia kaolinite: arsenic, cadmium, chromium, lead, uranium, and zinc. Thorium and radium are under study. Organic compounds which demonstrated high removal efficiencies include: phenol and BTEX.

Two pilot scale studies are planned for commencement in January 1992 for removal of 1000 ppm of lead in a soils laboratory and at a field site. Negotiations are underway for a third pilot scale study on one of three DOE uranium contaminated sites.

Key company personnel include renowned experts in geotechnical engineering, electrochemistry, and hazardous waste site remediation.

PART 2: Pilot- and Full-scale Technologies:
Detailed Information and Performance Data

Vendor name....: ELECTROKINETICS, INC.

Technology type: ELECTRICAL SEPARATION

Vendor services:

X Equipment manufacture

X Subcontractor for cleanup services

X Prime contractor for full-service remediation

Pilot-scale Equipment/Capabilities

Major unit processes:

The major components of the pilot treatment system include:

1. A 460 volt AC/DC power supply.
2. A proposed layout for the cathode and anode arrays (showing both plan, cross-section, and three dimensional view with plastic cover).
3. Conditioning fluid tanks for injection at anodes and disposal fluid tank for contaminants pumped from cathodes. arrays.
4. The anode arrays will be 3 inch diameter graphite rods (UCAR) while the cathodes will be copper wire.
5. Small pumps will be used at the cathodes to remove contaminated fluids.

PART 2: Pilot- and Full-scale Technologies:
Detailed Information and Performance Data (continued)

Vendor name....: ELECTROKINETICS, INC.

Technology type: ELECTRICAL SEPARATION

Number of pilot-scale systems:

3 Planned/in design

2 Under construction

___ Constructed

Pilot-scale facility is:

_ Transportable

_ Fixed

X In situ

Pilot capacity range per hour. Capacity of batch processes is prorated.

2.00 to 5.00 Cubic yard

Can you conduct pilot-scale treatability studies on some type of waste at your location? Yes

At a contaminated site? Yes

Quantity of waste needed for pilot-scale treatability study:

1 to 3 Cu. meters

Number of pilot-scale studies conducted on wastes from different sources or sites. Does not include tests on surrogate wastes.

___

PART 2: Pilot- and Full-scale Technologies:
Detailed Information and Performance Data (continued)

Vendor name....: ELECTROKINETICS, INC.

Technology type: ELECTRICAL SEPARATION

Full-scale Equipment/Capabilities

Major unit processes:

Full scale components are multiples of the equipment listed for pilot scale in question 23.

1. larger conditioning tanks would be required and the number of power supplies increased to match the full scale site size.

2. treatability study would be performed to determine the most optimum size for power supply.

3. economies could be effected on a larger sites by purchase of higher amperage pwoer supplies.

4. large sites would require covers to keep out precipitation.

5. safety equipment would include cyclone fencing, limited access, and posted signs.

PART 2: Pilot- and Full-scale Technologies:
Detailed Information and Performance Data (continued)

Vendor name....: ELECTROKINETICS, INC.

Technology type: ELECTRICAL SEPARATION

Full-scale facility is:

_ Transportable _ Fixed X In situ

Full capacity range per hour:

50.00 to 100.00 Cubic yard

Logistical requirements for transportable or in situ technologies:

Space (area)....: 3000 ft2

Water ....: 500 gals. per day

Electrical power: 75 amps

440 volts

Natural gas.....: ______ ft3 per day

Sewage access...: _ yes X no

"Ballpark" estimate of price range per unit of waste treated:

90.00 to 140.00 per Cubic yard

Price estimates shown above do not always include all indirect costs associated with treatment, such as: excavation, permits and treatment of residuals. For price comparisons, users should make certain that vendors provide estimates based on comparable remediation activities.

PART 2: Pilot- and Full-scale Technologies:
Detailed Information and Performance Data (continued)

Vendor name....: ELECTROKINETICS, INC.

Technology type: ELECTRICAL SEPARATION

Factors that have significant effect on unit price (1 is highest):

2	Initial contaminant concentration	__	Excavation
1	Target contaminant concentration	__	Waste handling
4	Waste quantity	__	Permitting
3	Depth of contamination	__	Pretreatment
__	Depth to ground water	__	Amount of debris
__	Residual quantity	__	Utility/fuel rates
__	Residual waste characteristics	__	Labor rates
__	Site preparation		

Others:

PART 2: Pilot- and Full-scale Technologies:
Detailed Information and Performance Data (continued)

Vendor name....: ELECTROKINETICS, INC.

Technology type: ELECTRICAL SEPARATION

Number of full-scale cleanups initiated or completed by this firm using this technology:

______

For equipment manufacturers - estimated or actual number of full-scal cleanups by other firms using this equipment:

______

Major permits obtained for a full-scale system, and issuing authority (e.g., RCRA, TSCA, NPDES, and Clean Air Act).

Permit Type.......: ______
Issuing Authority.: ______

Permit Type.......: ______
Issuing Authority.: ______

Permit Type.......: ______
Issuing Authority.: ______

Permit Type.......: ______
Issuing Authority.: ______

Number of full-scale systems:

__1__ Planned/in design

_____ Under construction

_____ Constructed

PART 2: Pilot- and Full-scale Technologies:
Detailed Information and Performance Data (continued)

Vendor name....: ELECTROKINETICS, INC.

Technology type: ELECTRICAL SEPARATION

Treatability Study Capabilities (Bench Scale)

Can you conduct bench-scale treatability studies on some types of waste at your location: X yes _ no

Number of bench-scale studies conducted to date.
Does not include tests on surrogate wastes:

15

Description of bench-scale testing procedures:

For lead testing, lead is adsorbed first on clay specimens. Anodes and cathods faces are composed of graphite. Tests run for different time intervals. At the end of tests, clay specimen is cut into sections and analyzed for lead. Tests run up to 25-30 days. Plots of final lead concentration over initial lead concentration versus normalized distance from anodes are used to measure mass lead removals. Lead tests at up to 1000 ppm demonstrated 90 percent mass removals. Lead was plated onto cathodes. Similar type treatability studies would be run for other hazardous metals, radionuclides, and organic bases.

SUMMARY OF PERFORMANCE DATA

Vendor name....: ELECTROKINETICS, INC.

Technology type: ELECTRICAL SEPARATION

Contaminant, contaminant group, or pollutant parameter:

Phenol

Untreated concentration range Mg/kg	Treated concentration range Mg/kg	Equipment Scale
500.000 to 1000.000	25.000 to 50.000	Bench scale

Waste description:

Phenol contamination of Georgia kaolinite soil

Soil classification:

Clay

Comments:

SUMMARY OF PERFORMANCE DATA

Vendor name....: ELECTROKINETICS, INC.

Technology type: ELECTRICAL SEPARATION

Contaminant, contaminant group, or pollutant parameter:

Lead

Untreated concentration range Mg/kg	Treated concentration range Mg/kg	Equipment Scale
100.000 to 1000.000	15.000 to 250.000	Bench scale

Waste description:

Pb(II) adsorbed on Georgia kaolinite soil

Soil classification:

Clay.

Comments:

SUMMARY OF PERFORMANCE DATA

Vendor name....: ELECTROKINETICS, INC.

Technology type: ELECTRICAL SEPARATION

Contaminant, contaminant group, or pollutant parameter:

Uranium

Untreated concentration range Mg/kg	Treated concentration range Mg/kg	Equipment Scale
917.000 to 1021.000	50.000 to 150.000	Bench scale

Waste description:

Uranyl nitrate adsorbed on Georgia kaolinite soil

Soil classification:

Clay.

Comments:

Units are PC i/g

06/11/93

SUMMARY OF PERFORMANCE DATA

Vendor name....: ELECTROKINETICS, INC.

Technology type: ELECTRICAL SEPARATION

Contaminant, contaminant group, or pollutant parameter:

Cadmium

Untreated concentration range Mg/kg	Treated concentration range Mg/kg	Equipment Scale
100.000 to 200.000	10.000 to 15.000	Bench scale

Waste description:

Cd(II) adsorbed on Georgia kaolinite soil

Soil classification:

Clay.

Comments:

REPRESENTATIVE CLEANUP PROJECTS

Vendor name : ELECTROKINETICS, INC.

Technology type: ELECTRICAL SEPARATION

Site name : Ethyl Corporation

City : Baton Rouge State: LA

Country : USA

Project type : LEAD CONTAMINATION

Client contact : Dr. Don Park

Affiliation : ____

Phone number : (504) 388-7575

Equipment Scale:

_ Bench scale

X Pilot scale

_ Full scale

Project status (Month/Year):

Contracted : 10/92

Underway : ____

Completed/To be completed : ____

Waste description:

Lead(II) in surface clays

AVAILABLE REFERENCES

Vendor name : ELECTROKINETICS, INC.

Technology type: ELECTRICAL SEPARATION

Reference: EPA Project Eksite Coop Agreement CR81828-01 - Interim Progress Report

Source:

Name/Organization: Randy Parker/ Office of Research & Dev.

Address: Risk Reduction Eng. Lab

26 W. Martin Luther King Drive

City : Cincinnati

State : OH

Zip : 45268

Phone number: (513) 569-7271

06/11/93

AVAILABLE REFERENCES

Vendor name : ELECTROKINETICS, INC.

Technology type: ELECTRICAL SEPARATION

Reference: US Patent & Trademark Office/Patent Pending

#071443.936 "Electrokinetic Decontamination of Soils & Slurries

Source:

Name/Organization: Don Pennington

Address: Office of Technology Transfer

LSU

City : Baton Rouge

State : LA

Zip : 70803

Phone number: (504) 388-6830

AVAILABLE REFERENCES

Vendor name : ELECTROKINETICS, INC.

Technology type: ELECTRICAL SEPARATION

Reference: Several papers available on requests on Removal of Phenols, Metals, Organics from Fine-Grained Soils

Source:

Name/Organization: Yalcin B. Acar - Electrokinetics Inc.

Address: Louisiana Business & Technology Center

South Stadium Drive

City : Baton Rouge

State : LA

Zip : 708036100

Phone number: (504) 388-3992

UNITED STATES ENVIROMENTAL PROTECTION AGENCY
VENDOR INFORMATION SYSTEM FOR INNOVATIVE TREATMENT TECHNOLOGIES (VISITT)

Part 1: General Information and Technology Overview

Date submitted: 11/15/91

Developer/Vendor name: HORSEHEAD RESOURCE DEVELOPMENT CO., INC.

Street address: 300 Frankfort Road

City: Monaca State: PA Zip: 15061

Country: USA

Contact name: Regis J. Zagrocki
and title...: Senior Engineer

Contact phone: (412) 773-2279 Fax Number: (412) 773-2217

Telex number: ( ) -

Standard technology type:

SLAGGING - OFF-GAS TREATED

Technology name assigned by vendor (e.g., trade name):

Technology is being or has been tested in EPA SITE Program ? Yes

Literature on technology available on request ? Yes

Part 1: General Information and Technology Overview (continued)

Vendor name....: HORSEHEAD RESOURCE DEVELOPMENT CO., INC.

Technology type: SLAGGING - OFF-GAS TREATED

General description of technology:

The HRD Flame Reactor technology is a HTMR process for the treatment of metal-bearing wastes. In a two-stage, high-temperature system, carbonaceous fuel is combusted with oxygen-enriched air under fuel-rich conditions in the first stage (burner section) followed by pneumatic injection of the waste into the hot (2,200-2,500 degree C) reducing flame in the second stage (reactor section). The intensive process conditions allow reaction times to be short (less than one-half second) and permit a high waste throughput. Close control of the operating parameters enables extraction of valuable metals and destruction of hazardous organic constituents.

The process temperature inside the reactor section is between 1,400 and 1,850 degrees C. In the high-temperature reducing atmosphere, metals such as zinc, lead, arsenic, and cadmium are vaporized from the waste along with volatile components such as alkali and halide compounds. Less volatile metals such as copper, nickel, and cobalt, if present in sufficient quantities, coalesce as a molten alloy. The remaining components of the waste, including some metal oxides such as those of iron, melt into a molten slag.

The reactor feeds into a slag separator, or horizontal cyclone, where the process gases and volatile compounds are separated from the molten materials. The slag is continuously tapped and solidified on a non-contact, water-cooled, vibrating conveyor. The process gases are drawn from the slag separator through the offgas system where the vapors are post-combusted with ambient air and condensed as metal oxides, and all remaining H_2 and CO are combusted to water vapor and carbon dioxide. The gases are subsequently cooled, and the mixed metal oxide particulate is collected in a pulse-jet baghouse. A clean offgas is discharged to the atmosphere.

Part 1: General Information and Technology Overview (continued)

Vendor name....: HORSEHEAD RESOURCE DEVELOPMENT CO., INC.

Technology type: SLAGGING - OFF-GAS TREATED

Technology highlights:

HRD's Flame Reactor technology is uniquely suited to the recovery and recycling of metal contaminants from a variety of wastes. High operation flexibility for different wastes is possible because of a thorough understanding of the process chemistry, controlled metering of input streams, and reliable analysis of feed and products. Also, the Flame Reactor process:

- recovers recyclable metal-enriched products;
- produces a non-hazardous slag;
- destroys organic compounds;
- utilizes a variety of fuels, including high and low BTU coal, coke, and natural gas;
- can be constructed in modules which are easily transported to remote locations.

Part 1: General Information and Technology Overview (continued)

Vendor name....: HORSEHEAD RESOURCE DEVELOPMENT CO., INC.

Technology type: SLAGGING - OFF-GAS TREATED

Technology status:

_ Bench scale or emerging. Technology shown to be feasible through the use of bench-top equipment in the laboratory. Available data cannot be used to scale up to full scale in the absence of additional pilot-scale or full-scale experience for similar applications.

_ Pilot scale. Available equipment is of sufficient size to verify technology feasibility or establish the design and operating conditions for a full-scale system. However, it is not of the size typically used for a cleanup.

X Full scale. Available equipment is sized and commercially available for actual site remediation.

Potential or actual waste/media treated:

X Soil

X Sludge

X Solid

X Natural sediment

_ Ground water in situ

Part 1: General Information and Technology Overview (continued)

Vendor name....: HORSEHEAD RESOURCE DEVELOPMENT CO., INC.

Technology type: SLAGGING - OFF-GAS TREATED

Potential or actual contaminants and contaminant groups treated by this technology:

Organic

_ Halogenated volatiles

_ Halogenated semivolatiles

_ Nonhalogenated volatiles

_ Nonhalogenated semivolatiles

_ Organic pesticides/herbicides

_ Dioxins/furans

_ PCBs

_ Polynuclear aromatics (PNAs)

_ Solvents

_ Benzene-toluene-ethylbenzene-xylene (BTEX)

_ Organic cyanide

_ Organic corrosives

Inorganic

X Heavy metals

X Nonmetallic toxic elements

_ Radioactive metals

_ Asbestos

X Inorganic cyanides

_ Inorganic corrosives

Miscellaneous

_ Explosives/propellents

X Organometallic pesticides/herbicides

Others:

FOIL206720

Part 1: General Information and Technology Overview (continued)

Vendor name....: HORSEHEAD RESOURCE DEVELOPMENT CO., INC.

Technology type: SLAGGING - OFF-GAS TREATED

General sources or types of industrial waste or contaminated sites that the technology can address:

X Agriculture

X Battery recycling/disposal

_ Chloro-alkali manufacturing

X Coal gasification

_ Dry cleaners

X Electroplating

_ Herbicide manufacturing/use

X Industrial landfills

X Inorganic/organic pigments

X Machine shops

X Metal ore mining and smelting

_ Municipal Landfill

_ Munitions Manufacturing

_ Paint/ink formulation

X Pesticide manufacturing/use

_ Petroleum refining and reuse

_ Photographic products

_ Plastics manufacturing

_ Pulp and paper industry

_ Other organic chemical manufacturing

X Other inorganic chemical manufacturing

X Semiconductor manufacturing

_ Rubber manufacturing

_ Wood preserving

_ Uranium mining

Others:

Metal recycling

Part 1: General Information and Technology Overview (continued)

Vendor name....: HORSEHEAD RESOURCE DEVELOPMENT CO., INC.

Technology type: SLAGGING - OFF-GAS TREATED

Technology limitations:

The waste must be fine and free flowing so that it can be pneumatically injected into the reactor. Therefore, pretreatment in the form of drying and size reduction might be required. The preferred specifications are less than 5% moisture and a PSD of 80% less than 75 microns. However, material with 15% moisture and a PSD of 80% less than 1000 microns has been sucessfully treated.

The total concentration of recoverable metal in the waste should be greater than 5% to produce a metal-enriched product suitable for recycling. For wastes with lower levels of metals, the Flame Reactor would act as a vitrification process, encapsulating the metals in a vitrified, non-hazardous slag.

Technology status comments:

A demonstration plant with a name plate capacity of 20,000 tons per year has been operated at Monaca, PA since June 1983. A wide variety of wastes and residues have been successfully treated in full-scale tests, including over 2,000 tons of electric arc furnace steel making baghouse dust (K061). HRD is now expanding the application of Flame Reactor technology to hazardous waste site remediation.

HRD draws on more than a century of metal industry experience for the treatment of metal-bearing wastes.

Test costs are $1,000 - 1,800 per ton of waste.

PART 2: Pilot- and Full-scale Technologies:
Detailed Information and Performance Data

Vendor name....: HORSEHEAD RESOURCE DEVELOPMENT CO., INC.

Technology type: SLAGGING - OFF-GAS TREATED

Vendor services:

X Equipment manufacture

X Subcontractor for cleanup services

X Prime contractor for full-service remediation

Pilot-scale Equipment/Capabilities

Major unit processes:

HRD operates a full-scale demonstration plant for Flame Reactor process tests at Monaca, PA. The facility is fully equipped with control and monitoring devices, and possesses all data collection and sample access points necessary to obtain information for commercial economic evaluation.

An indirect, steam-heated dryer and a hammermill are available to dry and crush material prior to Flame Reactor processing, if necessary.

PART 2: Pilot- and Full-scale Technologies:
Detailed Information and Performance Data (continued)

Vendor name....: HORSEHEAD RESOURCE DEVELOPMENT CO., INC.

Technology type: SLAGGING - OFF-GAS TREATED

Number of pilot-scale systems:

_____ Planned/in design

_____ Under construction

__1__ Constructed

Pilot-scale facility is:

_ Transportable

X Fixed

_ In situ

Location of fixed facility:

City: Monaca State: PA

Pilot capacity range per hour. Capacity of batch processes is prorated.

0.90 to 2.70 Tons

Can you conduct pilot-scale treatability studies on some type of waste at your location? Yes

At a contaminated site? No

Quantity of waste needed for pilot-scale treatability study:

10 to 100 Tons

Number of pilot-scale studies conducted on wastes from different sources or sites. Does not include tests on surrogate wastes.

1

PART 2: Pilot- and Full-scale Technologies:
Detailed Information and Performance Data (continued)

Vendor name....: HORSEHEAD RESOURCE DEVELOPMENT CO., INC.

Technology type: SLAGGING - OFF-GAS TREATED

Full-scale Equipment/Capabilities

Major unit processes:

HRD operates a full-scale Flame Reactor facility at Monaca, PA. This plant is the same one described in the "pilot-scale" section for testing purposes. A Part B permit application for the Monaca plant was submitted in 1988.

Full-scale feed preparation (crushing and drying) equipment is not yet available.

PART 2: Pilot- and Full-scale Technologies:
Detailed Information and Performance Data (continued)

Vendor name....: HORSEHEAD RESOURCE DEVELOPMENT CO., INC.

Technology type: SLAGGING - OFF-GAS TREATED

Full-scale facility is:

_ Transportable X Fixed _ In situ

Location of fixed facility :

City: Monaca State: PA

Full capacity range per hour:

0.90 to 2.70 Tons

Logistical requirements for transportable or in situ technologies:

Space (area)....: ________ ft2

Water ....: ________ gals. per day

Electrical power: ________ amps

________ volts

Natural gas.....: ________ ft3 per day

Sewage access...: _ yes _ no

"Ballpark" estimate of price range per unit of waste treated:

150.00 to 300.00 per Ton

Price estimates shown above do not always include all indirect costs associated with treatment, such as: excavation, permits and treatment of residuals. For price comparisons, users should make certain that vendors provide estimates based on comparable remediation activities.

PART 2: Pilot- and Full-scale Technologies:
Detailed Information and Performance Data (continued)

Vendor name....: HORSEHEAD RESOURCE DEVELOPMENT CO., INC.

Technology type: SLAGGING - OFF-GAS TREATED

Factors that have significant effect on unit price (1 is highest):

2 Initial contaminant concentration
3 Target contaminant concentration
4 Waste quantity
__ Depth of contamination
__ Depth to ground water
__ Residual quantity
__ Residual waste characteristics
__ Site preparation
__ Excavation
__ Waste handling
__ Permitting
1 Pretreatment
__ Amount of debris
__ Utility/fuel rates
__ Labor rates

Others:

PART 2: Pilot- and Full-scale Technologies:
Detailed Information and Performance Data (continued)

Vendor name....: HORSEHEAD RESOURCE DEVELOPMENT CO., INC.

Technology type: SLAGGING - OFF-GAS TREATED

Number of full-scale cleanups initiated or completed by this firm using this technology:

______

For equipment manufacturers - estimated or actual number of full-scal cleanups by other firms using this equipment:

______

Major permits obtained for a full-scale system, and issuing authority (e.g., RCRA, TSCA, NPDES, and Clean Air Act).

Permit Type.......: EPA RD&D Hazardous Waste Storage & Treatment
Issuing Authority.: U.S. EPA Pennsylvania DFR

Permit Type.......: ______
Issuing Authority.: ______

Permit Type.......: ______
Issuing Authority.: ______

Permit Type.......: ______
Issuing Authority.: ______

Number of full-scale systems:

_____ Planned/in design

_____ Under construction

____1 Constructed

PART 2: Pilot- and Full-scale Technologies:
Detailed Information and Performance Data (continued)

Vendor name....: HORSEHEAD RESOURCE DEVELOPMENT CO., INC.

Technology type: SLAGGING - OFF-GAS TREATED

Treatability Study Capabilities (Bench Scale)

Can you conduct bench-scale treatability studies on some types of waste at your location: _ yes X no

Number of bench-scale studies conducted to date. Does not include tests on surrogate wastes:

______

Description of bench-scale testing procedures:

SUMMARY OF PERFORMANCE DATA

Vendor name....: HORSEHEAD RESOURCE DEVELOPMENT CO., INC.

Technology type: SLAGGING - OFF-GAS TREATED

Contaminant, contaminant group, or pollutant parameter:

Lead

Untreated concentration range Mg/kg	Treated concentration range Mg/kg	Equipment Scale
4.350 to 6.800	0.000 to < 0.330	Full scale

Waste description:

secondary lead
soda slag

Soil classification:

Comments:

EPA SITE demonstration

05/28/93

SUMMARY OF PERFORMANCE DATA

Vendor name....: HORSEHEAD RESOURCE DEVELOPMENT CO., INC.

Technology type: SLAGGING - OFF-GAS TREATED

Contaminant, contaminant group, or pollutant parameter:

Cadmium

Untreated concentration range Mg/kg	Treated concentration range Mg/kg	Equipment Scale
7.610 to 15.800	0.000 to < 0.050	Full scale

Waste description:

secondary lead
soda slag

Soil classification:

Comments:

EPA SITE demonstration

REPRESENTATIVE CLEANUP PROJECTS

Vendor name : HORSEHEAD RESOURCE DEVELOPMENT CO., INC.

Technology type: SLAGGING - OFF-GAS TREATED

Site name : National Smelting and Refining Co.

City : Atlanta State: GA

Country : USA

Project type : EPA SITE DEMONSTRATION PROGRAM

Client contact : Donald Oberacker

Affiliation : U.S. EPA - RREL

Phone number : (513) 569-7510

Equipment Scale:

_ Bench scale

_ Pilot scale

X Full scale

Project status (Month/Year):

Contracted : ____

Underway : ____

Completed/To be completed : 3/91

Waste description:

Secondary lead soda slag-residue from battery recycling

REPRESENTATIVE CLEANUP PROJECTS

Vendor name : HORSEHEAD RESOURCE DEVELOPMENT CO., INC.

Technology type: SLAGGING - OFF-GAS TREATED

Site name : C&R Battery Co., Inc.

City : Richmond State: VA

Country : USA

Project type : TREATABILITY STUDY

Client contact : Andrew Oravetz

Affiliation : Versar

Phone number : (800) 283-7727

Equipment Scale:

_ Bench scale

_ Pilot scale

X Full scale

Project status (Month/Year):

Contracted : 10/91

Underway : ____

Completed/To be completed : ____

Waste description:

Treatability study on lead-contaminated soil

AVAILABLE REFERENCES

Vendor name : HORSEHEAD RESOURCE DEVELOPMENT CO., INC.

Technology type: SLAGGING - OFF-GAS TREATED

Reference: U.S. Patent 4,654,077 Method for the Pyrometallurgical Treatment of Finely Divided Materials - March 31, 1987

Source:

Name/Organization: J.F. Pusateri, et al

Address: __________

City : __________

State : __

Zip : __________

Phone number: ( ) -

AVAILABLE REFERENCES

Vendor name : HORSEHEAD RESOURCE DEVELOPMENT CO., INC.

Technology type: SLAGGING - OFF-GAS TREATED

Reference: U.S. Patent 4,732,368 Apparatus for the Pyrometallurgical Treatment of Finely Divided Materials - March 22, 1988

Source:

Name/Organization: J.F. Pusateri, et al

Address: ______

______

City : ______

State : __

Zip : ______

Phone number: ( ) -

05/28/93

AVAILABLE REFERENCES

Vendor name : HORSEHEAD RESOURCE DEVELOPMENT CO., INC.

Technology type: SLAGGING - OFF-GAS TREATED

Reference: C.O. Bounds & J.F. Pusateri, "EAF Dust Processing in the Gas-Fired Flame Reactor Process," February 1990

Source:

Name/Organization: Lead-Zinc-Tin '90 World Symposium

Address: 420 Commonwealth Dr.

City : Warrendale

State : PA

Zip : 15086

Phone number: (412) 776-9024

05/28/93

AVAILABLE REFERENCES

Vendor name : HORSEHEAD RESOURCE DEVELOPMENT CO., INC.

Technology type: SLAGGING - OFF-GAS TREATED

Reference: C.O. Bounds and J.F. Pusateri, "Lead Blast Furnace Slag Fuming via the Flame Reactor Process," August 1989

Source:

Name/Organization: Metallurgical Society of CIM

Address:

City :

State :

Zip :

Phone number: ( ) -

AVAILABLE REFERENCES

Vendor name : HORSEHEAD RESOURCE DEVELOPMENT CO., INC.

Technology type: SLAGGING - OFF-GAS TREATED

Reference: C.O. Bounds and J.F. Pusateri, "The FLAME REACTOR Process: A Solution for Lead/Zinc Industry Problems" 1988

Source:

Name/Organization: TMS-AIME

Address: 420 Commonwealth Dr.

City : Warrendale

State : PA

Zip : 15086

Phone number: (412) 776-9024

UNITED STATES ENVIROMENTAL PROTECTION AGENCY
VENDOR INFORMATION SYSTEM FOR INNOVATIVE TREATMENT TECHNOLOGIES (VISITT)

Part 1: General Information and Technology Overview

Date submitted: 09/30/91

Developer/Vendor name: GEOSAFE CORPORATION

Street address: 2000 Logston Avenue

City: Richland State: WA Zip: 99352

Country: USA

Contact name: JAMES E. HANSEN

and title...: DIRECTOR SALES AND MARKETING

Contact phone: (509) 375-3268 Fax Number: (509) 375-4838

Telex number: ( ) -

Standard technology type:

VITRIFICATION - OFF-GAS TREATED

Technology name assigned by vendor (e.g., trade name):

Technology is being or has been tested in EPA SITE Program ? Yes

Literature on technology available on request ? Yes

Part 1: General Information and Technology Overview (continued)

Vendor name....: GEOSAFE CORPORATION

Technology type: VITRIFICATION - OFF-GAS TREATED

General description of technology:

ISV involves the electric melting of contaminated solids for purposes of destroying/removing hazardous organics and immobilizing/removing hazardous inorganic contaminants in a glass and microcrystalline residual product form. Organics are destroyed by pyrolysis (i.e., thermal decomposition); inorganics are immobilized by chemical incorporation in the melt and resulting residual product. ISV may be applied to contaminated solid media such as soil, sediment, tailings and /or sludge. The material may be treated in situ (i.e., where presently located) or in a staged location. Four electrodes are typically used in a square array for treating individual melts (batches) of up to 1000 tons. Typical soil melt temperature is 1,600-2,000 degrees C. Large-scale processing rates are 4-6 tons/hr; the process operates 24 hr/day. An off-gas collection hood is employed over the treatment zone to collect gases/vapors evolving from the treatment volume and to direct them to a treatment system involving quenching, scrubbing, mist elimination, heating, filtering, and activated carbon adsorption unit processes. The process equipment is mounted on three over-the-road trailers and may be quickly mobilized to a site. The process may be powered by utility power or by diesel generator. Typical applications require 800-1000 kWh/ton for treatment.
The residual ISV product offers 20-45% volume reduction, and excellent structural, weathering, and biotoxicity properties.

Part 1: General Information and Technology Overview (continued)

Vendor name....: GEOSAFE CORPORATION

Technology type: VITRIFICATION - OFF-GAS TREATED

Technology highlights:

* ISV holds the ability to simultaneously process mixtures of organic, inorganic, and radioactive materials.

* The in situ nature of ISV allows treatment without the cost and hazard associated with excavation, handling, pre-treatment, and transportation.

* Typical vitrified product is unequalled in volume reduction (20-40% for most soils), structural strength (10X the compressive/tensile strength of unreinforced concrete), weathering (no freeze/thaw or wet/dry damage), chemical leaching (surpasses TCLP), biotoxicity (acceptable for near surface life forms), and life expectancy (geologic time period).

* ISV is typically the least costly alternative for difficult sites involving organic plus inorganic contaminant types.

* ISV enjoys good public and regulatory acceptance. It is recognized as one of the more advanced innovative technologies having a sound technical basis developed by Battelle Memorial Institute for the U.S. Department of Energy. ISV is being developed for widespread use at DOE sites.

Part 1: General Information and Technology Overview (continued)

Vendor name....: GEOSAFE CORPORATION

Technology type: VITRIFICATION - OFF-GAS TREATED

Technology status:

_ Bench scale or emerging. Technology shown to be feasible through the use of bench-top equipment in the laboratory. Available data cannot be used to scale up to full scale in the absence of additional pilot-scale or full-scale experience for similar applications.

_ Pilot scale. Available equipment is of sufficient size to verify technology feasibility or establish the design and operating conditions for a full-scale system. However, it is not of the size typically used for a cleanup.

X Full scale. Available equipment is sized and commercially available for actual site remediation.

Potential or actual waste/media treated:

X Soil

X Sludge

X Solid

X Natural sediment

_ Ground water in situ

Part 1: General Information and Technology Overview (continued)

Vendor name....: GEOSAFE CORPORATION

Technology type: VITRIFICATION - OFF-GAS TREATED

Potential or actual contaminants and contaminant groups treated by this technology:

Organic

- X Halogenated volatiles
- X Halogenated semivolatiles
- X Nonhalogenated volatiles
- X Nonhalogenated semivolatiles
- X Organic pesticides/herbicides
- X Dioxins/furans
- X PCBs
- X Polynuclear aromatics (PNAs)
- X Solvents
- X Benzene-toluene-ethylbenzene-xylene (BTEX)
- X Organic cyanide
- X Organic corrosives

Inorganic

- X Heavy metals
- X Nonmetallic toxic elements
- X Radioactive metals
- _ Asbestos
- X Inorganic cyanides
- X Inorganic corrosives

Miscellaneous

- X Explosives/propellents
- X Organometallic pesticides/herbicides

Others:

Part 1: General Information and Technology Overview (continued)

Vendor name....: GEOSAFE CORPORATION

Technology type: VITRIFICATION - OFF-GAS TREATED

General sources or types of industrial waste or contaminated sites that the technology can address:

X Agriculture
X Battery recycling/disposal
X Chloro-alkali manufacturing
X Coal gasification
X Dry cleaners
X Electroplating
X Herbicide manufacturing/use
X Industrial landfills
X Inorganic/organic pigments
X Machine shops
X Metal ore mining and smelting
X Municipal Landfill
X Munitions Manufacturing
X Paint/ink formulation
X Pesticide manufacturing/use
X Petroleum refining and reuse
X Photographic products
X Plastics manufacturing
X Pulp and paper industry
X Other organic chemical manufacturing
X Other inorganic chemical manufacturing
X Semiconductor manufacturing
X Rubber manufacturing
X Wood preserving
X Uranium mining

Others:

FOIL206748

Part 1: General Information and Technology Overview (continued)

Vendor name....: GEOSAFE CORPORATION

Technology type: VITRIFICATION - OFF-GAS TREATED

Technology limitations:

* Large-scale ISV equipment is limited to total organic concentration in the treated media of 10 wt%. This limit is related to the off-gas treatment systems capability to handle the heat load and volume of off gases.

* Applications involving high water recharge rates into the treatment volume require additional energy for water removal. Applications involving hydraulic conductivity/recharge velocity greater than 10-4 cm/sec should employ recharge limiting measures such as slurry walls or pumping down of water table.

* Inorganic debris (e.g., metal, concrete, asphalt) is limited to 20 vol% unless special provisions are made.

* Individual void volumes within the treatment volume must not exceed 150 cu-ft in size; this is a off-gas system volumetric limitation.

Technology status comments:

ISV is being developed by Geosafe Corporation for hazardous chemical applications. The technology is also being developed for radioactive applications by Battelle Memorial Institute for the U.S. Department of Energy. More than 115 tests at bench-, engineering-, pilot-, and large-scale have been conducted since 1980. More than 30 additional tests are presently planned for conduct within the next 12-18 months.

ISV has been selected as a preferred remedy at 10 private, EPA-Superfund, and DOD sites within the U.S. The technology has yet to be used on a commercial basis at large-scale. Two of the site selections have now reached the remediation contract stage; others are at various stages of testing, design, or regulatory affairs.

Geosafe's large-scale off-gas collection equipment is currently being redesigned based on damage suffered in a recent testing incident. It is currently estimated that Geosafe's large-scale remediation services will be available late in 1992.

PART 2: Pilot- and Full-scale Technologies:
Detailed Information and Performance Data

Vendor name....: GEOSAFE CORPORATION

Technology type: VITRIFICATION - OFF-GAS TREATED

Vendor services:

X Equipment manufacture

X Subcontractor for cleanup services

X Prime contractor for full-service remediation

Pilot-scale Equipment/Capabilities

Major unit processes:

ISV is performed at four (4) scales: bench (5 lb), engineering (150 lb), pilot (50 tons), and large (1000 tons). Geosafe performs treatability/pilot testing at engineering-scale; and is able to translate those results to large-scale appplication. Therefore, for purposes of this section, Geosafe's engineering-scale equipment will be described as it may be used for pilot testing.

The pilot testing system employs a 30 kW multiple tap transformer for supplying energy to up to four electrodes. The electrodes may be of the pre-placed (to depth) or moveable (lowered during processing) type. Testing is done within a steel enclosure which houses a 110-gallon drum containing the contaminated and clean solid media. Off-gases are drawn off the test container through a sampling section where several sampling trains may be installed. Thereafter, off-gases go through a condenser and activated carbon.

PART 2: Pilot- and Full-scale Technologies:
Detailed Information and Performance Data (continued)

Vendor name....: GEOSAFE CORPORATION

Technology type: VITRIFICATION - OFF-GAS TREATED

Number of pilot-scale systems:

_____ Planned/in design

_____ Under construction

1 Constructed

Pilot-scale facility is:

X Transportable

_ Fixed

_ In situ

Pilot capacity range per hour. Capacity of batch processes is prorated.

20.00 to 30.00 Pounds/hr

Can you conduct pilot-scale treatability studies on some type of waste at your location? Yes

At a contaminated site? Yes

Quantity of waste needed for pilot-scale treatability study:

60 to 100 Pounds

Number of pilot-scale studies conducted on wastes from different sources or sites. Does not include tests on surrogate wastes.

18

PART 2: Pilot- and Full-scale Technologies:
Detailed Information and Performance Data (continued)

Vendor name....: GEOSAFE CORPORATION

Technology type: VITRIFICATION - OFF-GAS TREATED

Full-scale Equipment/Capabilities

Major unit processes:

(a) Power conditioning system, including 3,750 kVa multiple tap transformer, electrodes, and cables.
(b) Off-gas collection hood, 55-ft diameter.
(c) Quencher, water spray type.
(d) High efficiency venturi scrubber (pH controlled)
(e) Mist eliminater (vane type)
(f) Heater
(g) Filter bank (HEPA)
(h) Adsorption column (activated carbon)
(i) Induction blower.

PART 2: Pilot- and Full-scale Technologies:
Detailed Information and Performance Data (continued)

Vendor name....: GEOSAFE CORPORATION

Technology type: VITRIFICATION - OFF-GAS TREATED

Full-scale facility is:

_ Transportable _ Fixed X In situ

Full capacity range per hour:

4.00 to 6.00 Tons/hour

Logistical requirements for transportable or in situ technologies:

Space (area)....: 7000 ft2

Water ....: 50 gals. per day

Electrical power: 290 amps

13800 volts

Natural gas.....: ____ ft3 per day

Sewage access...: X yes _ no

"Ballpark" estimate of price range per unit of waste treated:

300.00 to 500.00 per Ton

Price estimates shown above do not always include all indirect costs associated with treatment, such as: excavation, permits and treatment of residuals. For price comparisons, users should make certain that vendors provide estimates based on comparable remediation activities.

PART 2: Pilot- and Full-scale Technologies:
Detailed Information and Performance Data (continued)

Vendor name....: GEOSAFE CORPORATION

Technology type: VITRIFICATION - OFF-GAS TREATED

Factors that have significant effect on unit price (1 is highest):

___	Initial contaminant concentration	5	Excavation
___	Target contaminant concentration	___	Waste handling
4	Waste quantity	___	Permitting
1	Depth of contamination	___	Pretreatment
___	Depth to ground water	___	Amount of debris
___	Residual quantity	2	Utility/fuel rates
___	Residual waste characteristics	___	Labor rates
6	Site preparation		

Others:

3 - water recharge rate if processing in saturated zone.

PART 2: Pilot- and Full-scale Technologies:
Detailed Information and Performance Data (continued)

Vendor name....: GEOSAFE CORPORATION

Technology type: VITRIFICATION - OFF-GAS TREATED

Number of full-scale cleanups initiated or completed by this firm using this technology:

______

For equipment manufacturers - estimated or actual number of full-scal cleanups by other firms using this equipment:

______

Major permits obtained for a full-scale system, and issuing authority (e.g., RCRA, TSCA, NPDES, and Clean Air Act).

Permit Type.......: RCRA Closure Plan
Issuing Authority.: NC

Permit Type.......: CERCLA Removal
Issuing Authority.: MI

Permit Type.......: CERCLA/TSCA Demonstration
Issuing Authority.: WA

Permit Type.......: ______
Issuing Authority.: ______

Number of full-scale systems:

2 Planned/in design

______ Under construction

______ Constructed

PART 2: Pilot- and Full-scale Technologies:
Detailed Information and Performance Data (continued)

Vendor name....: GEOSAFE CORPORATION

Technology type: VITRIFICATION - OFF-GAS TREATED

Treatability Study Capabilities (Bench Scale)

Can you conduct bench-scale treatability studies on some types of waste at your location: X yes _ no

Number of bench-scale studies conducted to date. Does not include tests on surrogate wastes:

16

Description of bench-scale testing procedures:

Treatability/pilot testing involves geochemical, chemical, and physical analytical tests to fully characterize solid media and contaminants prior to testing. Testing involves placing contaminated media within large amount of clean media within test container. Small-scale ISV melt is performed, utilizing 30 kW, 4-electrode system, within contaminated volume. Pre-test, during-test, and post-test samples are analyzed to determine disposition of contaminants including DRE and mass balance when appropriate. Volume reduction is measured. Samples of residual product are characterized and submitted to TCLP leach testing when appropriate. Operational data is gathered to allow scale-up cost estimates. Testing objectives include: 1) demonstration that technology works on the specific solid/contaminant mixture involved, 2) production of process performance data pertinent to the destruction/removal/immobilization treatment of the contaminants, 3) production of operating performance data needed to perform cost estimates and remedial design, and 4) production of sample residual product for community relations purposes. Clean adjacent soil is analyzed to ensure that migration of contaminants did not occur during processing.

SUMMARY OF PERFORMANCE DATA

Vendor name....: GEOSAFE CORPORATION

Technology type: VITRIFICATION - OFF-GAS TREATED

Contaminant, contaminant group, or pollutant parameter:

Pesticides (DDD, DDE, DDT, Aldrin, Dieldrin, etc.)

Untreated concentration range Mg/kg	Treated concentration range Mg/kg	Equipment Scale
0.021 to 535.000	ND to ND	Pilot scale

Waste description:

Uncontainerized contamination in soil and sludge

Soil classification:

Various sand to clay

Comments:

Depending on initial concentrations, process DRE for pesticides has been 99.999-99.99999+%

SUMMARY OF PERFORMANCE DATA

Vendor name....: GEOSAFE CORPORATION

Technology type: VITRIFICATION - OFF-GAS TREATED

Contaminant, contaminant group, or pollutant parameter:

VOCS (Toluene, MEK, TCE, Xylenes)

Untreated concentration range Mg/kg	Treated concentration range Mg/kg	Equipment Scale
230.000 to 3533.000	ND to ND	Pilot scale

Waste description:

Containerized and uncontainerized contaminants in soil and sludge

Soil classification:

Various sand to clay

Comments:

DRE 99.999-99.99999+%

SUMMARY OF PERFORMANCE DATA

Vendor name....: GEOSAFE CORPORATION

Technology type: VITRIFICATION - OFF-GAS TREATED

Contaminant, contaminant group, or pollutant parameter:

Pentachlorophenol (PCP)

Untreated concentration range Mg/kg	Treated concentration range Mg/kg	Equipment Scale
4000.000 to 4000.000	ND to ND	Pilot scale

Waste description:

Uncontained contamination in soil

Soil classification:

Clay

Comments:

99.99999% DRE

SUMMARY OF PERFORMANCE DATA

Vendor name....: GEOSAFE CORPORATION

Technology type: VITRIFICATION - OFF-GAS TREATED

Contaminant, contaminant group, or pollutant parameter:

PCB

Untreated concentration range Mg/kg	Treated concentration range Mg/kg	Equipment Scale
8.000 to 19000.000	ND to ND	Pilot scale

Waste description:

Uncontained contamination in soil, sludge and sediment.

Soil classification:

Various sand to clay

Comments:

99.99-99.9999+% DRE

SUMMARY OF PERFORMANCE DATA

Vendor name....: GEOSAFE CORPORATION

Technology type: VITRIFICATION - OFF-GAS TREATED

Contaminant, contaminant group, or pollutant parameter:

Heavy Metals

Untreated concentration range Mg/kg	Treated concentration range Mg/kg	Equipment Scale
17.000 to 65000.000	ND to ND	Pilot scale

Waste description:

Uncontainerized contaminants in soil and sludge

Soil classification:

Various sand and clay

Comments:

Hg 100% removal
All others 99.96+%
Retention and removal
All passed TCLP

REPRESENTATIVE CLEANUP PROJECTS

Vendor name : GEOSAFE CORPORATION

Technology type: VITRIFICATION - OFF-GAS TREATED

Site name : Parsons Chemical Works, Inc. *

City : Grand Ledge State: MI

Country : USA

Project type : SUPERFUND

Client contact : Robert Bowden

Affiliation : US EPA, Region V

Phone number : (312) 886-6236

Equipment Scale:

_ Bench scale

_ Pilot scale

X Full scale

Project status (Month/Year):

Contracted : 09/91

Underway : X

Completed/To be completed : ____

Waste description:

Pesticides, Hg, and dioxin in soil (4,000 tons)

REPRESENTATIVE CLEANUP PROJECTS

Vendor name : GEOSAFE CORPORATION

Technology type: VITRIFICATION - OFF-GAS TREATED

Site name : Transformer Service Facility

City : ______ State: __

Country : USA

Project type : TSCA NATIONAL DEMONSTRATION

Client contact : Mr. Russ Stenzel

Affiliation : Betchtel Environmental

Phone number : (415) 768-3385

Equipment Scale:

_ Bench scale

_ Pilot scale

X Full scale

Project status (Month/Year):

Contracted : 09/90

Underway : ____

Completed/To be completed : ____

Waste description:

PCBs in soil (4,000 tons)

REPRESENTATIVE CLEANUP PROJECTS

Vendor name : GEOSAFE CORPORATION

Technology type: VITRIFICATION - OFF-GAS TREATED

Site name : Wasatch Chemical Co. (Lot 6) *

City : Salt Lake City State: UT

Country : USA

Project type : SUPERFUND

Client contact : Mr. Rowland Gow

Affiliation : Questar Corp.

Phone number : (801) 534-5594

Equipment Scale:

_ Bench scale

X Pilot scale

_ Full scale

Project status (Month/Year):

Contracted : 1990

Underway : ____

Completed/To be completed : 1990

Waste description:

Pesticides and dioxin in soil, sludge, and liquid in drums (100 1

REPRÈSENTATIVE CLEANUP PROJECTS

Vendor name : GEOSAFE CORPORATION

Technology type: VITRIFICATION - OFF-GAS TREATED

Site name : Site 10 Arnold Air Force Base

City : ______ State: TN

Country : USA

Project type : RCRA

Client contact : Clark Brandon

Affiliation : USAF

Phone number : (615) 454-7115

Equipment Scale:

_ Bench scale

X Pilot scale

_ Full scale

Project status (Month/Year):

Contracted : 1989

Underway : ____

Completed/To be completed : 1989

Waste description:

Organics and metals in soil (fire training pit), 10 tons

REPRESENTATIVE CLEANUP PROJECTS

Vendor name : GEOSAFE CORPORATION

Technology type: VITRIFICATION - OFF-GAS TREATED

Site name : Rocky Mtn. Arsenal, M-1 Holding Ponds *

City : Commerce City State: CO

Country : USA

Project type : SUPERFUND

Client contact : Rich Beyak

Affiliation : Woodward Clyde Consultants

Phone number : (303) 694-2770

Equipment Scale:

_ Bench scale

X Pilot scale

_ Full scale

Project status (Month/Year):

Contracted : 1990

Underway : ____

Completed/To be completed : 1990

Waste description:

M-1 Holding Ponds, pesticides/herbicides As, and Hg in soil and sludge (100 lb)

AVAILABLE REFERENCES

Vendor name : GEOSAFE CORPORATION

Technology type: VITRIFICATION - OFF-GAS TREATED

Reference: United States Patent 4,376,598, March 15, 1983 In Situ Vitrification of Soil.

Source:

Name/Organization: U.S. Patent Office

Address: Washington DC

City :

State :

Zip :

Phone number: ( ) -

AVAILABLE REFERENCES

Vendor name : GEOSAFE CORPORATION

Technology type: VITRIFICATION - OFF-GAS TREATED

Reference: Application and Evaluation Considerations for In Situ Vitrification Technology: A Treatment Process for Destruction and/or Permant Immobilization of Hazardous Materials.

Source:

Name/Organization: James E Hansen/ Geosafe Corp.

Address: 2000 Logston Ave.

City : Richland

State : WA

Zip : 99352

Phone number: (509) 375-3268

AVAILABLE REFERENCES

Vendor name : GEOSAFE CORPORATION

Technology type: VITRIFICATION - OFF-GAS TREATED

Reference: In Situ Vitrification Applications (3rd Forum on Innovative Hazardous Waste Treatment Technologies Domestic and International, June 11-13, 1991)

Source:

Name/Organization: James E. Hansen/ Geosafe Corporation

Address: 2000 Logston Ave.

City : Richland

State : WA

Zip : 99352

Phone number: (509) 375-3268

AVAILABLE REFERENCES

Vendor name : GEOSAFE CORPORATION

Technology type: VITRIFICATION - OFF-GAS TREATED

Reference: Treatment of Heavy Metal Contaminated Soil by In Situ Vitrification (4th Annual Hazardous Materials Management Conference, April 3-5, 1991)

Source:

Name/Organization: James E. Hansen/ Geosafe Corp.

Address: 2000 Logston Ave.

City : Richland

State : WA

Zip : 99352

Phone number: (509) 375-3268

AVAILABLE REFERENCES

Vendor name : GEOSAFE CORPORATION

Technology type: VITRIFICATION - OFF-GAS TREATED

Reference: Applications of In Situ Vitrification to PCB-Contaminated Soil (3rd International Conference for the Remediation of PCB Contamination, March 25-26, 1991)

Source:

Name/Organization: James E. Hansen/ Geosafe Corp.

Address: 2000 Logston Ave.

City : Richland

State : WA

Zip : 99352

Phone number: (509) 375-3268

Appendix C

Appendix C

APPENDIX C

Results of Solid Treatment Systems (STS)
Treatability Study

GREENFIELD ENVIRONMENTAL

RECEIVED
OCT 08 1991
H & A of New York

September 18, 1991

Ms. Elizabeth D. Henderson
H & A of New York
189 North Water Street
Rochester, NY 14604

Dear Elizabeth:

Thank you for this opportunity to be of service. The Greenfield Research Group has finished their treatability work on the sample submitted for the Roth Bros. site in Syracuse, New York.

The contaminants of concern were lead and PCB levels above regulatory standards.

The results of the treatability study indicate that the material can be stabilized with reagents at reasonable add levels. The TCLP results indicate that the material can be treated to levels adequate for disposal at a Class I landfill as a RCRA waste. The treated material would meet the best demonstrated available technology (BDAT) for processing prior to landfilling to meet the landban restrictions. ??

The STS technology is an adaption of the "Trezek Method" for polysilicate stabilization as a commercial application. The process is directed at TCLP results as well as the multiple extraction test (MEP) for long-term efficacy. This approach is explained in the literature we've previously supplied to you. In short, the MEP results indicated that no changes were required to our standard lead treatment program. As a result, we have not applied any additional research to reducing or economizing the cost of treatment at this time. That has much to do with a lack of experience on our part with the site conditions and the potential for other operational efficiencies.

The treatability study indicated that the addition of 0.25 quarts each of two liquid silicate reagents and less than ten percent dry cementitious reagent was necessary.

NO.JES.REMED.H&AOFNY.RSL

7441 LINCOLN WAY, SUITE 250
GARDEN GROVE, CA 92641
~~(714) 897-7377~~
FAX · (714) 894-9693

Ms. Elizabeth D. Henderson
H & A OF NEW YORK
September 18, 1991
Page 2

The cost to perform the work at this time is:

**Fifty-six Dollars ($56.00) per ton
of pretreated soil to the Treatment Unit**

Please be aware that certain economics of operation can be applied and contingencies for a distant job site are included in this price. This estimate includes screening of oversize material. Payment is by belt scale of pretreated soil only, the screened oversize material does not cross the belt scale. This generally decreases weight volumes by 15% to 30% and limits expense to only treatable soil.

Thank you for this opportunity to be of service to you. Should you require further clarification, or need additional information, please do not hesitate to contact me at (714) 897-2277.

Respectfully,

GREENFIELD ENVIRONMENTAL
Solid Treatment Systems Division

James E. Steele
Sales Manager

JES/nd

NO.JES.REMED.HA.AOFNY.RSL

TCLP fluid had Ph of 4.9

Ms. Elizabeth D. Henderson
H & A OF NEW YORK
September 18, 1991

STS is still the lead Poly sol...

Summary of Analytical Results

Roth Brothers - Rochester, NY

B-1 Treat

Average Results

SAMPLE ORIGIN	EXTRACTION METHOD	Cu	Pb	Zn	Cd	Ni	UNITS	pH	PCB'S PPM
B-1	Totals 3050	3600	222	2500	8.5	490	mg/kg	--	--
Initial	TCLP	.80	2.36	5.75	.04	.29	mg/l	6.66	5.80
B-2	Totals 3050	2840	8150	4300	425	86	mg/kg	--	--
Initial	TCLP	15.30	50.15	71	5.60	.19	mg/l	7.86	3.47
B-2 Treated	TCLP	.3	.06	.14	.005	.13	mg/l	11.42	-- ND?

10% increase in volume

Where is Bench 1?

Were semi-volatiles tested?

Appendix D

Appendix D

APPENDIX D

Technical Paper
Polysilicate Treatment of Heavy Metals in Soil

TECHNICAL PAPERS

Polysilicate Treatment of Heavy Metals in Soil

the work of

George J. Trezek

The Technical Foundation for:

SOLID TREATMENT SYSTEMS

Polysilicate Treatment of Heavy Metals in Soil

by

George J. Trezek
Department of Mechanical Engineering
University of California
Berkeley, CA 94720

Introduction

A commercial cost effective process has been developed for the mitigation of heavy metals in solid and semisolid substrates. These would include soil, sludge, various types of residue, incinerator ash, filter press cake and others. The process which utilizes a blend of polysilicates was initially developed as a treatment system for dealing with the heavy metal found in auto shredder residue. The initial development work began in 1985 and progressed from the laboratory bench scale phase, through the pilot phase and then final commercialization.

Within the industry this particular polysilicate process has become known as the Trezek Process. There are on the order of six to ten vendors offering various forms of the so called solidification/stabilization technology. Most of these processes produce a solid material which often results from casting the processed material into a mold and allowing it to solidify. In addition, these processes may require considerable quantities of silicates and cementitious materials resulting in large volume increases approaching one hundred percent of the initial untreated material. On the other hand, the Trezek Process produces a friable material using relatively small quantities of polysilicate and cementitious materials. For example, after curing, treated soil can be backfilled and recompacted with conventional earthmoving equipment.

Following a brief description of the nature of the technology, the discussion will deal with the application of the process to soil treatment.

Nature of the Technology

Although the basic features of the technology have been previously reported [1,2], a brief description is given for the unfamiliar reader. The overall treatment is thought to occur in three steps, i.e. a) wetting of the material requiring treatment by the polysilicate water blend, b) the addition of cementitious material, and c) curing. During the first step, it is necessary that the material become thoroughly wetted by the polysilicate water blend. This is usually accomplished by having the material fall through a spray or fluid injection system as it enters the blender or mixture. As a result of this procedure it is believed that the metal oxides are transformed into metal metasilicates. After an appropriate residence time in the mixing phase, the treated material exits the blender and must be allowed to cure for a one to two day period.

During the curing process, the material is usually turned several times with a loader i.e. turned from one stockpile into a new stockpile etc. If properly handled, the cured material will be friable and suitable for on-site recompaction. In addition to reducing the soluble concentrations of the metals (STLC values) to acceptable values which are in compliance with the regulations, the treatment also has the effect of increasing the mean size of the material. Typical data for treated soil shows an order of magnitude increase in mean size. This has the important aspect of mitigating the effects of the total concentrations of metals. For example, when treated samples are subjected to the decision tree analysis, the effects of elevated total concentrations on downwind biological receptors due to airborne transmissions are mitigated by the large particle size.

Application to Soil Treatment

The commercialization of the process for soil treatment was predicated on the development of mobile systems which could process and treat materials on site. This approach differed from the earlier experience with auto shredder residue in which the treatment process was integrated into the plant processing line. Currently five auto shredding facilities in California use the process to treat their residue on a daily basis. On the order of five to seven hundred tons per day of materials are treated using the inline process. Although the nature of the technology is the same for either an inline process of a mobile system, the basic difference lies in the type of permit required for operation. The inline systems are arranged in a manner such that the materials are further recovered after the process. Consequently, a permit to process hazardous waste is not required. On the other hand, the mobile system requires a site specific transportable treatment unit (TTU) permit.

Thus far, the progression of activities following the TTU approach has lead to the development of a commercial mobil system capable of processing at the rate of 100 tons per hour. Prior to operating at this rate, experience was gained on a pilot scale mobil system and operating a large commercial system at reduced through puts. A discussion of these systems, their application to field conditions, and the subsequent results follow.

Pilot Mobile System

The first mobile system demonstration of heavy metal contaminated soil treatment was conducted at the Port of Los Angeles. Based on the experience gained with the auto shredder systems, a mobile system, partially funded by the California Department of Health Service, was assembled and utilized for the demonstration project. The system, designed to process soil like material at the rate of five to eight tons per hour, was arranged on two trailers. One trailer contained the pug mill mixer, small air compressor for operating the automatic sampler, the chemical delivery system and a feed hopper for regulating the flow of cementitious material.

The mixer is powered by fifteen horsepower direct drive hydraulic motor. The polysilicates are stored in a one hundred gallon stainless steel tank, metered into a twenty five gallon water mixing tank and pumped to a series of spray nozzles located at the base of the feed hopper. An automatic sampler, attached to the discharge opening, can be operated at preset intervals for the collection of representative samples. The second trailer is an enclosed end dump trailer and serves as the cementitious material storage system. When the units are assembled on the site a screw conveyor connects the storage system to the mixing trailer.

The soil for treatment was taken from the finger pier portion of the former National Metals site located at berths 212 to 215 at the Port of Los Angeles. Six piles, each containing about twenty tons of material, were gathered from previously sampled sites on the finger pier and treated separately. The polysilicates used in this treatment were those manufactured by Lopat Inc. of Wanamassa, New Jersey, available under the trade name of K20. Because the site has been used for scrap metal operations the principal metals of concern were lead, zinc, cadmium, copper and nickel. Non-hazardous oversized materials such as metals, rocks, wood etc. were removed by screening prior to treatment. The result of the treatment on the six separate piles are summarized in Table I. With the exception of copper, the reduction in the STLC levels was well over ninety to one hundred percent. In general, the treatment was not as effective on copper where the highest reduction was eighty seven percent.

TABLE I

Field Test Results for Soil from the Port of Los Angeles Finger Pier

STLC Concentrations*

	lead		zinc		cadmium		copper		nickel	
Sample Pile	Initial	Final	Initial	Final	Initial	Final	Initial	Final	Initial	Final
1	213	5.01	528	4.3	2.1	0.03	127	24.8	18.2	1.9
2	149	13.0	443	13.0	1.6	0.11	92.5	29.9	10.9	2.1
3	127	0.5	258	0.06	2.1	0.01	70.5	15.9	9.7	0.80
4	86	1.9	225	4.6	0.9	0.04	113	33.1	28.7	2.6
5	152	1.6	454	18.2	2.0	0.02	128	26.7	28.6	1.4
6	107	3.3	242	1.2	1.5	0.1	91.8	12.3	19.2	1.2

*CAM Test Results

Large Scale Demonstration and Commercial Operation

Based on the success of the pilot demonstration, a commercial size treatment system capable of through puts in the one hundred ton per hour range was implemented by Solid Treatment Systems (STS). This system is an adaptation of a self-contained pug mill mixing plant which embodies the basic elements of the polysilicate treatment technology. The basic treatment unit trailer consists of twin feed hoppers, a twin screw pug mill, cementitious material storage silo, and discharge conveyor. The storage silo is hydraulically elevated after the unit arrives on the site. A belt scale is mounted on the infeed conveyor. The polysilicate delivery system is arranged in a separate trailer. The arrangement is such that various blends of silicates can be mixed, combined with an appropriate amount of water and delivered to the mixing trailer. The details of the system have been previously described [3].

The soil used for treatment was located at the Tamco Steel site in Rancho Cucamonga, California. Approximately 5000 tons of heavy metal contaminated soil resulting from the sale of adjacent property had been excavated and stockpiled in a fenced area on the Tamco property. Because of the previous scrap metal operations, the range of concentrations of the metals of concern as determined by the CAM wet extraction test were a) lead from 48 to 89 mg/l, b) zinc from 180 to 320 mg/l and c) cadmium from 1 to 12 mg/l. Before the entire pile could be treated, the Department of Health Services required a preliminary or small scale test using the STS equipment. In order to conduct this initial demonstration, approximately 160 tons of material was removed from the 5000 ton stockpile. The material was preconditioned in the sense that large rocks, stones and other metal debris were removed prior to treatment. The system was operated at a feed rate of about 40 tons per hour.

The testing protocol as established by DHS was as follows: samples of pretreated material of about 1 kg were taken from the feed conveyor at two minute intervals and placed in a clean plastic bucket. This bucket was changed at one hour intervals resulting in four composite samples. For the treated sample, an approximate 4 kg aliquot was taken every two minutes and placed in another clean plastic bucket. This bucket was changed every ten minutes resulting in twenty-four post treatment composite samples. During this test, measurements were made of all chemicals and water flow rates as well as the amount of cementitious material. In addition to evaluating the wet extraction concentrations of lead, zinc and cadmium, the weight loss during curing was also measured.

The results of these tests are summarized in Table II along with values of the sample mean and 80 percent confidence limits as determined by the Students t-test. An analysis by the DHS staff indicated that the final dilution factor accounting for cementitious material and retained water due to hydration was 1.11. Consequently, even after accounting for an 11 percent dilution, all metals were treated to non-hazardous levels. Further, fish bioassay tests conducted on three grab samples of treated material indicated the LC_{50} for each of the tests was higher than 750 mg/l. A size distribution analysis showed more than a sixfold increase in the mean particle size.

After the evaluation of the initial testing, the DHS issued a variance to STS to complete the treatment of the remaining Tamco soil. During the commercial phase of operations, the equipment was operated at a nominal rate of 65 tons per hour. The results for the remainder of the pile were similar to those obtained in the initial test. During the course of operations, several peculiarities of the treatment were observed. For example, if the treated material is left undisturbed during the curing, large monolithic blocks can form. However, daily mechanical turning during curing will produce a loose friable material. Further, if the threshold lower limit of polysilicate addition is exceeded, the treated samples will not meet the accepted STLC standards and will require the implementation of a modified retreatment protocol.

TABLE II

Wet Concentrations Before and After Treatment
(mg/l)

	LEAD		ZINC		CADMIUM	
	Before	After	Before	After	Before	After
	249	2.61 3.24 3.49 1.22 4.03 6.68	1356	8.85 9.10 9.14 2.57 9.29 32.20	12.30	0.142 0.087 0.101 0.028 0.102 0.114
	204	4.37 2.49 2.77 3.96 3.00 3.15	920	22.80 6.30 5.88 22.81 15.35 13.24	10.92	1.053 0.086 0.157 1.053 0.570 0.086
	204	2.49 2.88 1.87 7.27 5.83 4.26	760	6.27 21.60 8.84 37.20 15.11 31.60	10.50	0.074 0.857 0.128 0.463 0.890 0.652
	189	1.20 1.25 1.60 1.60 1.23 3.16	872	5.32 6.20 5.93 6.14 5.82 9.38	10.62	0.061 0.168 0.157 0.244 0.169 0.082
AVG	211	3.15	977	13.21	11.10	0.314
LCL	193	2.71	792	10.60	10.50	0.225
UCL	229	3.58	1162	15.8	11.70	0.403

AVG = AVERAGE
LCL = LOWER 80% CONFIDENCE LIMIT
UCL = UPPER 80% CONFIDENCE LIMIT

Site Clean Up Phase

The final phase in the commercialization of the technology involves the adaption of the treatment system to a large scale site remediation. A project involving the treatment of heavy contaminated soil on the remainder of berths 212 to 215 at the Port of Los Angeles is being undertaken by STS under subcontract to Chemical Waste Management. The project deals with a 23.5 acre site where the amount of material to be treated is estimated to be on the order of 60,000 tons. The treatment unit is configured to operate in the range of 100 to 125 tons per hour and will include the additional inline unit operations of ferrous separation and screening. Further, the system is equipped wit a certified belt scale. Prior to field application, the entire system was assembled, tested dismantled and ten moved to the site. A video of the site mobilization and operation is available through STS.

Conclusion

A cost effective polysilicate treatment is commercially available for the remediation of heavy metal contaminated residue and soil. The process evolved through a series of laboratory and pilot field tests. The overall development of the technology also involved the selection and integration of various pieces of equipment which could function as a reliable mobile system having good economics of scale. Consequently, even for large projects, a treatment system can be made operational in the field within one to two working days following conventional site preparation such as clearing, grading, etc. The process has been thoroughly evaluated by the California Department of Health Service.

References

Application of the Polysilicate to Heavy Metal Waste Streams, Trezek, G.J., Report prepared for the State of California Department of Health Services, 1987.

Application of the Polysilicate Technology to Heavy Metal Waste Streams, Part II - Mobile Systems and Field Demonstration, Trezek, G.J., Report for the State of California Department Health Services, 1988.

Polysilicate Heavy Metal Mitigation Technology, Trezek, G.J., Innovative Hazardous Waste Treatment Technology Series, H. Freeman, Technical Publ. Co., Inc., Lancaster, PA., to appear.

Appendix E

Appendix E

APPENDIX E

Petition for Variance to
Part 373, 376 Regulations

APPENDIX E

CORRECTIVE MEASURES STUDY
ROTH BROS. SMELTING CORPORATION
EAST SYRACUSE, NEW YORK

Petition For Variance to Part 373, 376 Regulation

On 16 February 1993, USEPA promulgated final regulations addressing two types of units used for remedial purposes under the RCRA corrective action authorities. Final regulations for the management of Corrective Action Management Units (CAMUs) and temporary units (TU) went into effect 19 April 1993. However, these regulations cannot be applied in New York State until adopted by the State, unless performed under order with variance from selected State RCRA requirements. It is for this purpose that the petitioner, Roth Bros. Smelting Corp., is seeking a variance to utilize the CAMU and TU concept to carry out corrective action under RCRA at its East Syracuse, New York Plant 2 site.

New York State is authorized for HSWA Corrective Action under Part 373 and Part 376 of 6NYCRR. The particular sections that regulate planned remedial actions at the Roth facility include Subpart 373-3 Interim Status Standards for Owners and Operations of Hazardous Waste Facilities, particularly sections referring to treatment requirements, and Subpart 376, The Land Disposal Restrictions.

According to a 8 June 1993 NYSDEC letter received by the petitioner, the Commissioner of NYSDEC will consider petitions to issue a variance allowing the application of CAMU rules to sites in New York. As was also suggested in the letter, this petition follows the guidance stipulated in Subpart S: Section 264.552 and Section 264.553.

This document includes directly, or by reference, discussion of the decision criteria for CAMU designations. Discussion is included regarding facilitation of reliable, effective, protective, and cost effective remedies; evaluation of risks during remediation activities; the effects on uncontaminated areas; the effect on minimizing future releases; timing; and the effect on enhancing long-term effectiveness of the remedy while minimizing land areas where wastes will remain in place. Certain documentation is required in conjunction with the designation of a CAMU which is summarized herein, but otherwise would be part of Corrective Measures Implementation (CMI) design.

General Authority

The USEPA Regional Administrator, or NYSDEC Commissioner in an authorized state, has the authority to designate an area at the facility as a Corrective Action Management Unit (CAMU) in accordance with the criteria found in Subpart S Section 264.552. One or more noncontiguous CAMUs may be designated at the facility. The granting of a variance to use a CAMU relieves the site from complying with land disposal requirements and minimum treatment technology requirements, while allowing rapid implementation of effective, protective and cost-effective corrective measures.

Proposed Treatment Details

The technology alternative justified in the Corrective Measure Study (CMS, July 1993) for the Roth Bros. Smelting Corp. site (see CMS Sections VI and VII) includes excavation and off-site disposal of high PCB soils (>50 ppm), and polysilicate stabilization or equivalent treatment of other lead and PCB containing soils (TCLP >5 ppm, total lead >825 ppm, and PCBs >25 ppm). The stabilization process is accomplished by excavating the affected soils for treatment in a mobil unit placed approximately in the current affected fill area. The treatment consists of wetting the contaminated soils with a polysilicate water mixture and/or proprietary reagents that convert the lead metal oxides to metal metasilicates or lead apatite mineral crystals. Small amounts of a cementatious material are added and the resulting material is cured for a period of time (4-48 hrs.). The treated material is friable and may be backfilled and recompacted with conventional earthmoving equipment and remains workable over the long term. The material is rendered non hazardous for TCLP lead and both total lead and PCBs are stabilized in a non-leachable matrix.

Facilitates Reliable, Effective, Protective and Cost Effective Remedies

Subpart S allows the establishment of a CAMU when its creation will facilitate the most appropriate remedy to be applied to the site. The technology alternative has been justified in this regard in the Corrective Measures Study (see CMS Section VII). The technology has been determined to be reliable over both the short-term and long-term. Polysilicate stabilization (or equivalent methods) is effective in treating the lead contained in the soil, rendering the soil incapable of leaching lead and PCB contaminants into groundwater resources. The effectiveness of the technology is dependent on proper curing times before the soils are backfilled. Designation of a CAMU at the Roth Bros site would allow for proper, well-controlled processing and curing of materials prior to backfilling on the site, thereby providing a consistently treated non-hazardous solid, minimizing surface impoundments and site business interruptions.

Application of the selected technology, under the requirements of a CAMU, would be more protective of human health and environmental quality than would be possible without the CAMU. If excavated materials were to be treated off-site, they would need to be transported to the off-site treatment/disposal location. Transportation of contaminated soils would increase the risks to off-site receptors and simply shift toxicity, mobility and treatment issues to an off-site area.

The ability to conduct the treatment and backfill of stabilized materials on-site makes the application of the technology more cost-effective. Further, if materials were treated off-site, the site owner would be required to purchase significant amounts of clean backfill to return the site to usable condition.

CAMU Shall Not Increase Risks During Remediation

A treatability study has been completed for site soil samples. This testing has shown the risk of lead leaching to groundwater resources to be significantly diminished by the technology (>99% reduction in the leachability of lead and PCBs). By increasing the soil particle size, and changing the chemical composition of the lead, the risks due to site contamination will be reduced significantly. Soil particle size increases a minimum of 10%. A site-specific risk evaluation for this site (CMS Section 3-04) indicated potential soil dust concentrations above 825 ppm to trigger unacceptable risk. Increasing mean particle size by 10% or more will significantly reduce or eliminate the risk, particularly if combined with a minimal cover at a CAMU.

Since the application of the CAMU concept will allow treatment and replacement of soils onto the Roth Bros. site, the risks associated with contaminated materials will not increase during remediation activities. The area tentatively identified for the CAMU is centrally located in the fill area north of the plant. This location is a great distance removed from residential receptors (>0.5 mile). The technology application has been designed to control dust generation by using a primary wetting solution.

Placement of CAMU in Uncontaminated Areas

The areas of contamination above the health based criteria defined in the Corrective Measures Study are located at various areas of the facility property. Collection at a central treatment area, located on an already contaminated area, would be performed. The central treatment area would be primarily over the target contaminated area of the site. Due to the irregular shape of the existing main contaminated area, treatment and final placement in the designated CAMU would necessarily involve minimal adjacent areas that are currently not known to be contaminated. Collection of soils at a central treatment area will be more protective in that the treatment system equipment won't need to be remobilized on the site affecting several smaller contaminated areas closer to ongoing plant operations and personnel. Also some contaminated areas are located on the edges of the property or around facility structures making access for remediation difficult.

As much as is possible, the CAMU area will be defined to cover a minimum of uncontaminated area. It is estimated that the final CAMU footprint would be approximately 1.5 acres in size and will cover less than a one-third acre of area currently not known to be contaminated. This placement of the stabilized materials at one controlled location enhances Roth's ability to control future access to treated waste materials.

Post-Closure CAMU Management

The Regional Administrator is required to consider the long-term (post-closure) reliability and effectiveness of CAMU-related remedial actions. The treatment technology proposed for remediation of the Roth Bros. site has been shown to be effective and reliable over long-term application (see the CMS). Additionally, it is anticipated that quarterly sampling of groundwater monitoring wells will be conducted on a routine basis during post-closure to verify effectiveness. Groundwater will be tested for lead and PCBs to determine if any stabilized soils leach lead to groundwater resources. Treated cured soil piles will be tested for TCLP prior to backfill on site.

The Roth Bros. site is zoned industrial and is expected to remain industrial and involved in similar business activities. Use of the selected technology and placement in a centralized CAMU would allow optimum management of the treated material. The options of treating and leaving the material where it currently resides or removing it from the site significantly reduce Roth's ability to maintain long-term management.

CAMU Shall Expedite Timing of Remedial Implementation

The establishment of a CAMU will expedite the timing of remedial activities on the Roth site by providing for limited business interruptions and cost effective (affordable) solutions. Allowing contaminated soils to be brought to a centrally located treatment unit avoids the time consumed with setting-up, decontaminating and breaking down the equipment several times. The technology to be employed at the site can handle up to 100 tons of soil per hour. The estimated

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length of time for field work should be 4 to 6 weeks.

CAMU Shall Enable the Reduction in Toxicity, Mobility and Volume of Wastes

The establishment of a CAMU of the Roth Bros. site enables application of the polysilicate stabilization (or equivalent) technology in a practical manner. The technology has been demonstrated to reduce the toxicity of lead by converting the metal oxide to a metal metasilicate or apatite (phosphate) mineral form that is less bioavailable. The mobility of the lead and PCBs to groundwater is significantly reduced (99% reduction in TCLP values). Air mobility is decreased significantly by the stabilization process which has the effect of increasing the mean particle size for treated soils. Larger soil particles then are less transportable off-site as airborne dusts. The volume of wastes will be maintained the same or increased by only 10%. This represents the least volume increase of the viable on-site treatment options reviewed (see CMS Section VI).

CAMU Shall Minimize Areas Where Wastes Remain In Place

The establishment of a central CAMU area is the most appropriate way of minimizing the area where wastes remain in place. Wastes will be brought from the locations on the site determined to have greater than the risk based clean-up criteria of lead and PCBs.. These wastes currently occupy approximately 122,000 sq. ft. (2.8 acres) of area. Treated and cured wastes will be backfilled in the CAMU area, creating one area for post-closure management activities. As indicated above, the final CAMU would occupy approximately 66,500 sq. ft. (1.5 $\pm$ acre), a net reduction of the area affected.

Temporary Units Associated with the CAMU

The treatment system proposed to be operated on the Roth site is a mobile unit that will be removed from the site after use. The Regional Administrator is petitioned to consider any TUs along with the CAMU petition. The petitioner requests that the CAMU management program be considered to be inclusive of the particular requirements of the TUs.

In summary, the petitioner believes that the remedial activities and treatment technologies satisfy the criteria for creation of a CAMU at the Roth Bros. site. The establishment of a CAMU will allow a site remedy that is easily implemented, cost-effective and protective of short and long-term human health and environmental effects. The petitioner understands that the CAMU regulatory concepts have not been adopted by the State, and as such no CAMU activities can be implemented by the facility until the Commissioner accepts this variance petition. The petitioner requests that the state develop a means to allow the CAMU to be established and corrective action performed.

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